why & how?
PRIMARY SCIENCE TEACHING TRUST

Inclusive Approaches for Primary Science

JOELLE HALLIDAY

A Primary Science Teaching Trust Resource

Inclusive Approaches for Primary Science

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Foreword

At the Primary Science Teaching Trust, we want to see excellent science teaching in every primary classroom. This vision drives everything we do, but we know that some children find it difficult to engage with otherwise stimulating or exciting lessons. It is important to have a strong set of teaching and learning techniques at our disposal, so that every child has the opportunity to be inspired by science.

I am therefore delighted to introduce this pack, which details two helpful strategies for working with children who have special educational needs and disabilities. As with all PSTT resources, these approaches have been developed by teachers, with teachers. We hope you will find them just as helpful in your own classroom.

Martin Pollard
CEO, The Primary Science Teaching Trust

Acknowledgements

We extend grateful thanks to all the schools, teachers, teaching assistants and children involved in the Primary Science for All Project. In particular we thank Sam Kenny, Greg Mace, Rob Floyd and Anita Huckerby for their contributions to this resource.

Introduction

Imagine a great primary science lesson. What would children be doing? How would they be thinking and feeling? Everyone's image may be different but there would probably be some common features including a vibrant environment where children are actively engaged in developing their science knowledge and skills to find answers to their own questions. Children may be exploring, observing, predicting, collecting data, looking for patterns and drawing conclusions.

However for some children, difficulties with cognition and learning, additional physical and sensory needs, or social, emotional and behavioural issues, can mean that the 'buzz' of the primary science classroom is extremely challenging. Added to this, because of the barriers to learning they face, these children often have a history of failure which in itself can generate further difficulties, e.g. task avoidance.

In the classroom these barriers to learning can manifest as:

- poor attention and concentration
- low levels of engagement and participation
- lack of collaboration with others
- difficulties with processing information or managing instructions
- poor memory recall
- needing additional time to complete tasks
- poor organisation of resources
- difficulties with expressing thoughts or explaining thinking

The SEND evidence review by the EEF (2020) outlines, successful inclusion for children with barriers to learning depends on teachers and schools valuing diversity and considering, 'a learning problem not as something for which the child is to blame, but as a sign that something in the pupil's bioecological environment needs to be changed' (p21). For all children to be able to access the science curriculum (in both mainstream and special provision settings), the teacher needs to identify, and be responsive to, a child's specific needs. Ideally the child will be included in decisions made about the nature of the support they require, and the involvement of other agencies (e.g. parents, SENCO, teaching assistants, outside specialists) is also key. While the support for any particular child might be highly individualised, there are established approaches for teachers to use to facilitate engagement, enjoyment and progress with learning in science. In this guidance, two such approaches are described in detail, with illustrative 'stories' from teachers to show how they successfully adapted and applied the approaches for different children with varied and complex needs.

Background to the resource

Inclusive Approaches for Primary Science began as a two year curriculum development project, Primary Science for All, led by Sheffield Hallam University and funded by the Primary Science Teaching Trust. The project included a group of participant teachers from a mixture of primary school settings including special schools, pupil referral units attached to mainstream schools, and mainstream schools. All the teachers had a commitment to improving the inclusivity of primary science so that lessons would be accessible to all learners.

The project teachers received shared professional learning experiences to support the co-development of teaching and learning strategies and resources that value the expertise, ideas and practice of teachers and teaching assistants working with children with a diverse range of needs.

The project aimed to develop a repertoire of diverse, creative and responsive approaches that enable teachers to draw out and maximise individual children's strengths. After scoping possibilities for different approaches, the project focussed on two: Wonder Cupboards and Frames. These inclusive approaches were also designed to foster positive relationships, to reduce anxiety, and to aid communication and collaborative learning. The project teachers disseminated the approaches in their own settings and contributed to the development of effective CPD, particularly focusing on understanding differences to enable more personalised learning, as well as providing opportunities for individual children to demonstrate progress.

The Primary Science for All approach, led by Sheffield Hallam University, responded to challenges for children with diverse needs. The project team developed approaches and resources to support these needs. 'Inclusive Approaches for Primary Science' introduces these resources and outlines how teachers and teaching assistants (TAs) can incorporate them into their schools' own approaches to teaching and learning in science.

Aim of the Primary Science for All project

The aim of the project was to support teachers to develop inclusive practices and resources to ensure all children are motivated and engaged in their science lessons. The approaches developed are therefore particularly useful for supporting the learning of children with special educational needs and disabilities (SEND).

Fig 1. Project summary

Key to the value of the project was the focus on the professional development of teachers and TAs. A community of learning was established, including university staff, teachers and TAs from mainstream and special schools, and one teacher from a hospital school. The professional development was designed around individual teachers' and TAs' needs and experiences, and comprised face-to-face university project days, school-based resource development, and school visits. The group had a WhatsApp group chat to keep all the project participants in touch with each other throughout. Working together was critical to the resource development process. The university staff facilitated discussion, reflection and feedback, and provided expert challenge.

Fig 2. Primary Science for All project teachers sharing their innovations

University project days

- **Introduction to approaches and resources**
- **Co-creation of adapted resources**
- **Presentation of school based work to the community of learning**
- **Action planning for school based work**

Supported through:
– Coaching
– Critical reflection
– Peer coaching

School based resource development

- **Identifying barriers to learning**
- **Adapting resources to meet children's needs**
- **Experimenting with the approaches**
- **Observing and assessing impact**
- **Adapting resources and approaches**

Supported through:
– Coaching and mentoring

WhatsApp Group Chat

sharing ideas asking questions. Maintaining group cohesion

The WhatsApp group has been really nice to keep in touch with each other and pinch ideas from each other - and support each other as well; that's been really invaluable.

Project teacher

I'd say the best aspect has been working collaboratively it hasn't been like any other training I've done."

Project teacher

Having the opportunity to work with a mixture of SEN and mainstream teachers provided a much broader range of ideas/suggestions that could be adapted to our different settings.

Project teacher

Not only were we given resources and a model to follow (design, reflect, assess, re-design), we were also given time to explore and develop these ideas with access to expert advice at SHU.

Project teacher

Fig 3. Professional development cycle

Supporting children and building confidence

The Primary Science for All teachers and TAs explored ways to identify and measure children's progress. This included noting children's responses and changes in behaviour, collecting feedback through self-assessment tools, and completing child engagement profiles. In some cases, familiarity and confidence led to some independent and child-initiated use of the resources. Teachers and TAs reported that once the Frames had been introduced to children, they became increasingly confident with using them, which led to reduced anxiety.

Project leaders

Joelle Halliday

Senior Research Fellow, Sheffield Institute of Education, Sheffield Hallam University

Joelle is the project lead for Primary Science for All. She has a background in primary science professional development and school senior leadership. Joelle has worked in national and international contexts to design and lead professional development. She is the co-lead for the Wipro STEM Teacher Fellow and Teacher Mentor Programme and the Sheffield Institute of Education Research Engaged Practice Network. Teaching responsibilities include Masters module leader for Developing Others Through Mentoring and Coaching.

Andy Bullough

Senior Research Fellow, Sheffield Institute of Education, Sheffield Hallam University

Andy has a background in science education, professional development and the development of curriculum materials. He works on a range of projects including being the leader for the part time Masters, Professional Practice in Education. He supervises a range of Autism, Education and Psychology masters level students on their dissertation research projects.

Inclusive Approaches for Primary Science

Two key inclusive approaches were developed by the Primary Science for All project: Wonder Cupboards and Frames. Project days were used to explore the associated resources and look at the variety of ways in which they could be used in different SEND settings. Teachers and TAs worked together to trial and adapt the approaches for use in their own settings. Teachers and TAs reported back to the group, evaluated the outcomes together, and shared ideas for further development. The project's professional development leaders encouraged experimentation with the approaches and provided feedback to support evaluation of, and modifications to, the resources.

The Wonder Cupboard

Wonder Cupboards contain objects carefully displayed to arouse interest and stimulate curiosity. The cupboards can take many forms and the contents can be curated by adults or children. The project teachers and TAs developed a range of different Wonder Cupboards for their children. All the Wonder Cupboards contained a variety of artefacts used to develop a sense of awe and wonder, and generate lines of enquiry. Visits to the Wonder Cupboard could be initiated by the child or by the adult.

Use of the Wonder Cupboard involved developing a sense of anticipation and opening the cupboard. Children were invited to select an item of interest to them, explore it using their senses and ask questions about it. Question stem cards were used to promote a range of questions.

Primary Science for All teachers reported that the Wonder Cupboards can:

- be filled with interesting artefacts and materials to spark interest at the start of a new science topic
- be a repository for collections of interesting topic-related objects brought in from home to share with the class
- provide a quiet focus area to aid de-escalation and self-regulation of behaviour
- be a stimulus for questions and enquiries, and for talking and thinking about science

Examples of Wonder Cupboards and how they can be used

Fig. 4. Example of a Wonder Cupboard

Fig. 5. Making an exciting door to a Wonder Cupboard helps spark interest

Fig. 6. A miniature Wonder Cupboard for a lower primary topic on invertebrates. Children chose items to put into the mini-cupboard and they were encouraged to talk about their choices.

Fig. 7. Instead of a cupboard, a cabinet of drawers can be used, with each drawer containing one item. Each child has an allocated drawer so they can choose what to put inside it. Knowing what is in the drawer can help reduce anxiety.

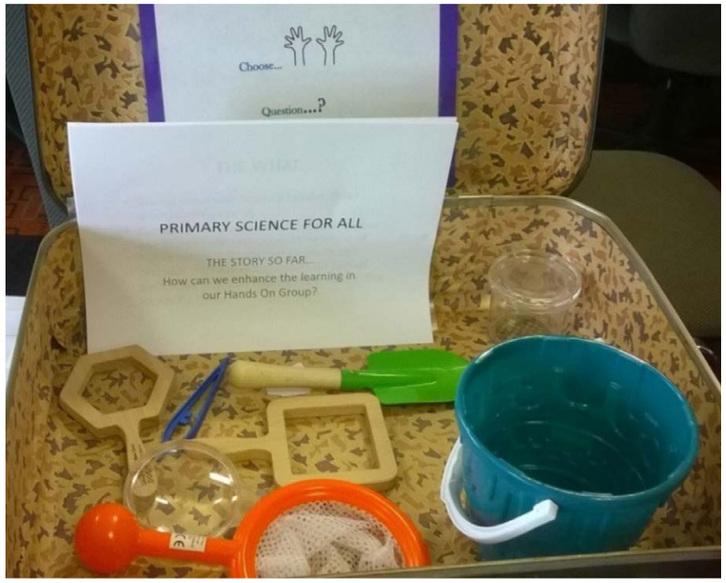


Fig. 8. A portable Wonder Suitcase containing equipment to support close observation and collection of natural materials from the outdoors. This was used (with TA support) by a small group of children exploring the outdoors.

Frames

The Frame is a form of graphic organiser, used as a tool to help remove barriers to learning experienced by some children in busy, hands-on, practical science lessons. By directing children's attention to each prompt in turn, the frame helped to break down instructions, information, questions, and concepts into smaller, manageable steps.

The Frame is an adaptable physical resource that comprises a border with a cut out centre into which an item of interest is placed. Each corner of the Frame has a prompt to focus a child's attention on the item in the centre. The Frame itself can be made by hand from paper or card, or an existing empty picture frame can also work well. The corner prompts can take a variety of forms, such as a written question or instruction, a prompt recorded on a 'talk button', or an image. The project teachers and TAs found that the Frames were very versatile, being easy to create and easy to use, and that they could be used to support thinking and learning in science for all ages and abilities. They are not intended to be a 'one size fits all'; rather, the whole idea is that they are created or adapted to suit the needs of particular individuals or groups of children.

"One of my children actually turned around and said, 'Well, I know what to do next.' So it's helping him to be a bit more self-directed and helping him to feel a bit more in control."

PROJECT TEACHER

"One child in the group really struggles with focus and attention and we've noticed using the Frames ... it's definitely helping him."

PROJECT TEACHER

Primary Science for All teachers and TAs found that Frames can:

- help children to focus on an item or task by surrounding and isolating it from external distractors
- improve inclusion and participation of children with SEND in mainstream classes
- be a tool to break down content into smaller parts
- help to structure experiences,
- help to build confidence
- diminish anxiety as children become familiar with the simple structure
- be easily adapted to meet the needs of individuals and groups
- be personalised and populated with appropriate stimulus questions for different activities
- be adapted by teachers, TAs and children
- provide signposts to structure the recall of an exploration or enquiry
- be a support for children for whom reading, and writing are barriers to learning
- be a 'go to' resource for children to select at the point of need
- provide a consistent approach that can be used across the curriculum

A **PROMPT** is included in each corner, e.g. a image, a question, a sound button		
	An **ARTEFACT** is placed in the middle, e.g. something from nature, an everyday item, a manmade object	
	Children can draw or record **OBSERVATIONS, IDEAS** and **QUESTIONS** in the spaces around the centre	

Fig. 9. Basic Frame template

Adapting the Frames

The versatility of the basic design allows teachers and TAs to adapt the Frames to meet the individual needs of different children.

The Frame adaptations made by the project teachers and TAs include:

- **Laminated write on wipe off Frames** for individual children (see fig. 10).
- **Sensory Frames** with images or items representing the senses attached to each corner. These act as sensory exploration prompts without the need for any text (see fig. 11).
- **Feedback Frames** with a feedback icon on each corner (smiley face/traffic light) to provide instant feedback in small steps. This helps to demonstrate progress and reduce anxiety (see fig. 12).
- **Talking Frames** with the written signposts or questions on each corner replaced by a talk button/ talking tin lid/talk peg so that children can engage in the activity without the need for reading text (see fig. 13).
- **Data handling Frames** where graphs or data are in the centre of the Frame. Signposts on each corner provide step-by-step support for data analysis without moving away from the given data (see fig. 14).
- **Enquiry Frames** which break down elements of the enquiry process into small progressive steps (see fig. 15).
- **3D empty picture Frames** which enable the children to carry the Frame with them and place over objects of interest (see fig. 16).

Examples of Frames and how they can be used

Fig. 10. **Laminated 'write on, wipe off' Frame.** This makes it quick and easy to personalise for individual children in response to their needs.

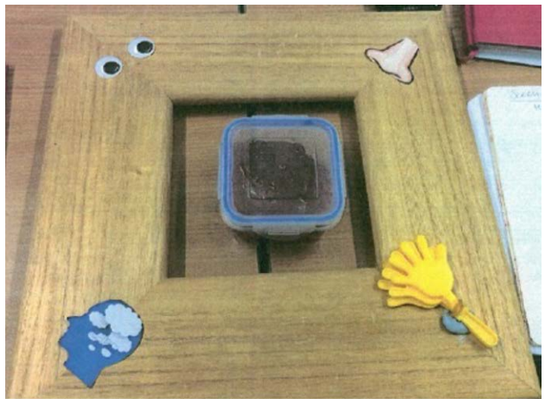


Fig. 11. **Sensory Frame**. Look, smell, touch and think. This Frame has prompts on each corner to encourage children to use their senses to explore the jelly.

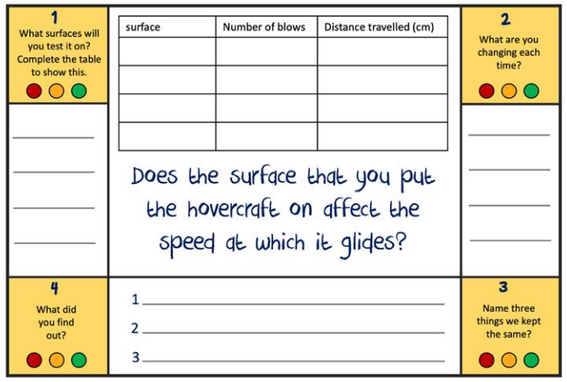


Fig. 12. **Feedback Frame** used here for science enquiry. This Frame was used to support thinking and discussion between a child and an adult during a practical investigation. It was designed to work with the PSTT resource Science in My Pocket. The traffic lights at each stage can be used to feedback on progress before moving on.

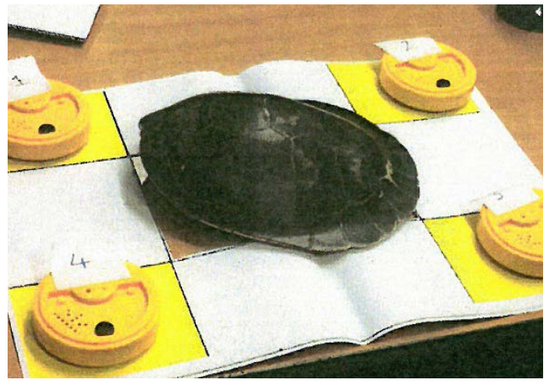


Fig. 13. **Talking Frame.** This Frame has a numbered 'Talking Tin Lid' on each corner. Children can press the lid to hear a question or prompt to encourage them to explore the item in the centre of the Frame.

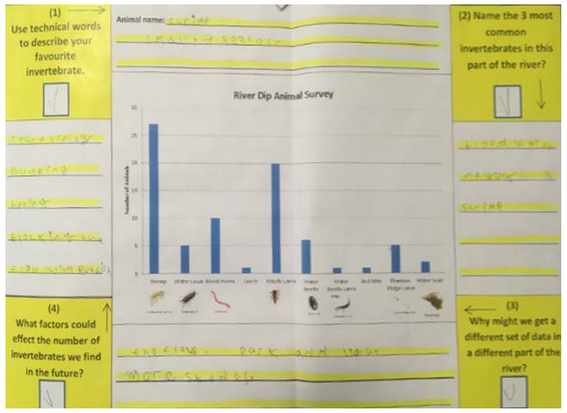


Fig. 14. **Data handling Frame.** Putting the data collected from a river dip in the centre of the Frame helped the children to explore and analyse their findings. The Frame guided their thinking. The final two steps moved their thinking beyond the investigation that took place, and this created opportunities for further investigation.

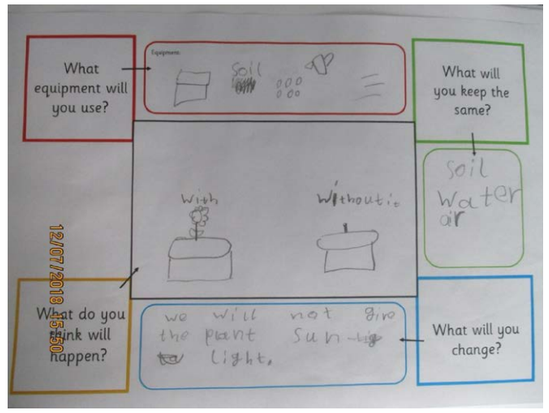
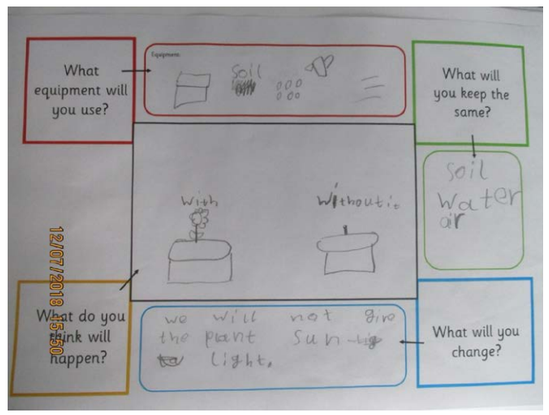


Fig. 15. **Enquiry Frame.** Arrows were used to guide the children through the planning stages of an investigation supported them to keep focused on the purpose of the enquiry and what they were trying to find out.

Fig. 16. **3D empty picture Frame.** 3D objects and prompt words were placed at the corners, making it particularly engaging for some children. Using this type of Frame is very adaptable as the objects and words can be easily changed, plus the Frame itself can be carried around by a child and placed over objects of interest.



Combined use of the Wonder Cupboard and the Frames

As well as using the Wonder Cupboard and Frames separately, the project teachers and TAs explored using them in conjunction with each other.

Fig. 17. **A Wonder Cupboard** was filled with different samples of material to stimulate a science enquiry through using Frames.

The Wonder Cupboard in fig.17 was a whole school resource. It contained a selection of different samples of material. Working in small groups, children took a material from the Wonder Cupboard. They placed the material in the centre of a Frame to help them explore it. Repeating this with new material samples helped to develop ideas for an enquiry. They then planned an investigation to find out which of the materials would be best at keeping a teddy bear dry. They used an Enquiry Frame (fig. 18) to support them with carrying out the investigation. The Frame provided some structure, and it prompted the use of scientific vocabulary and language. It also helped the children to sequence the enquiry process.

"When I was using the Wonder Cupboard with my children ... we just had some plain plastic laminated Frames... and I noticed that they were picking the Frames up and putting it over the objects that they were looking at."

PROJECT TEACHER

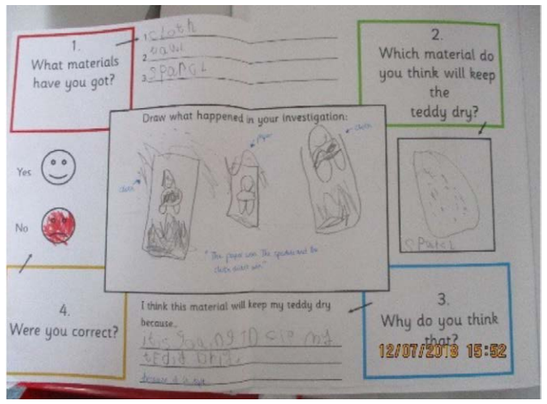


Fig. 18. **The Enquiry Frame** used to support an investigation into materials from the Wonder Cupboard.

Inclusive Approaches for Primary Science: teachers' stories

The Wonder Cupboard and Frames were used as part of an approach to teaching and learning which is inclusive and responsive to the needs of individual children. They were used both separately and together. The following teachers' stories describe how the resources were developed for different settings.

Sam's Story

Steps to Success

Sam Kenny

Bethlem and Maudsley Hospital School

I work in a Tier 4 psychiatric hospital school with children aged 7 – 12 who need to be in an inpatient hospital setting, having been admitted in crisis. They can be in hospital for anything from just a few days to several months. Our school offers individual ward-based teaching, as well as individual or small group teaching in a purpose-built school building. Whilst on roll, children follow the National Curriculum. The wide range of psychiatric illnesses and needs is reflected in the challenges faced in the classroom. As a result, classes:

- are of mixed age and ability
- are small (3-5 children)
- have a high staff to child ratio

Consequently, children follow a very personised curriculum. This is either based on their presenting needs or they follow work set by their community school. In terms of science, therefore, this can potentially result in two or three different lessons going on in the classroom simultaneously.

The Frames interested me because I wanted a 'system' that is highly personalised, can be adapted to a wide range of different science lessons and encourages engagement in lessons. As part of the Primary Science for All project, I carried out a small-scale study to assess children's engagement and five common factors affecting engagement were identified:

- preoccupation,
- limited academic resilience,
- low self-esteem and self-worth,
- rigid and inflexible thinking,
- poor social skills.

I thought that the Frames might reduce pre-occupation (lack of sustained focus on the content) in the lesson. I hoped that a reduction in pre-occupation would allow children to be successful, leading to an improvement in academic resilience and 'low self-esteem and self-worth'.

Design and Adaptability

The system I adopted was the Frame. I placed objects or a picture I wanted the children to focus on in the centre of the frame. There was a question in each corner of the Frame with space left for children to answer the questions.

By placing an object(s) in the middle, I aimed to encourage curiosity. The Frame provided physical structure to the task. It also made the lessons more tactile and presented an alternative approach from a worksheet. As the Frames are highly adaptable and can be individualised, they allowed different topics to be covered by different children, often at the same time.

The Frames were used as part of a lesson in conjunction with other strategies such as a 'This first... Then ...' approach. Using a progression line for a topic within a programme of study ensured that any initial work was always achievable and non-threatening, which helped to encourage initial engagement.

What changed?

I used a Guide to the Assessment of Learning Behaviour (GALTSB) to assess levels of child engagement without, and then with, the Frames. Note that the GALTSB is a measure of disengagement, so the lower the score, the more engaged the child is.

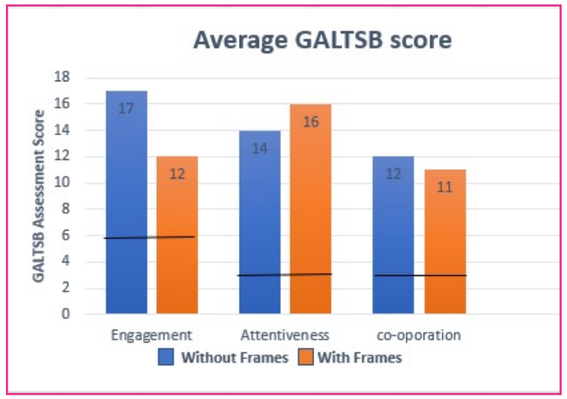


Fig 19. Comparison of children's engagement in lessons without and with the Frames

Treatment by the hospital also impacted on engagement in all lessons. However, the results did mirror my observations in practice. Fig. 19 shows that engagement and co-operation of the children did improve with the use of Frames, whereas levels of attentiveness declined.

Further reflections on the use of Frames

The Frames:

- worked best for children who need a 'hands on' experience to support learning
- made it easier for me to personalise learning
- allowed more leaning targets to be successfully met
- could be linked to other classroom management strategies

In terms of my own professional development, I think by focusing on the progression of skills, knowledge and understanding, my approaches to planning and the structure of my lessons also improved.

Resource development process

Over the course of the project, I reviewed the impact of the Frames and adapted them based on my observations and feedback. The next section gives two examples of Frames which illustrate the resource development process.

1. Early-stage Frame

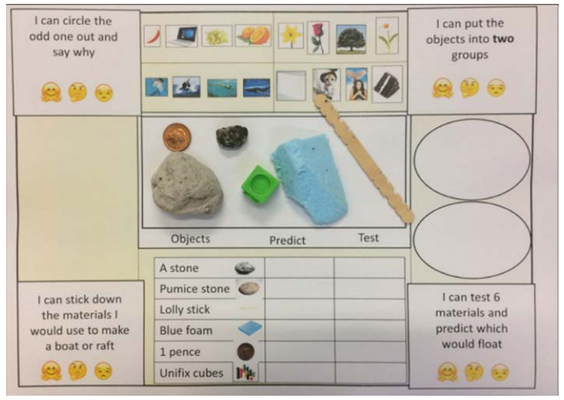


Fig. 20. Frame for the topic of forces to support learning about floating and sinking, falling objects and balanced forces (for ages 6-8)

Things to note:

- the initial question is non-threatening and achievable
- an investigation was included
- self-assessment after each question
- the self-assessment idea was soon dropped as it became too repetitive
- the design was thought to be too 'busy' which was distracting, and later versions were simplified

2. Later stage Frame

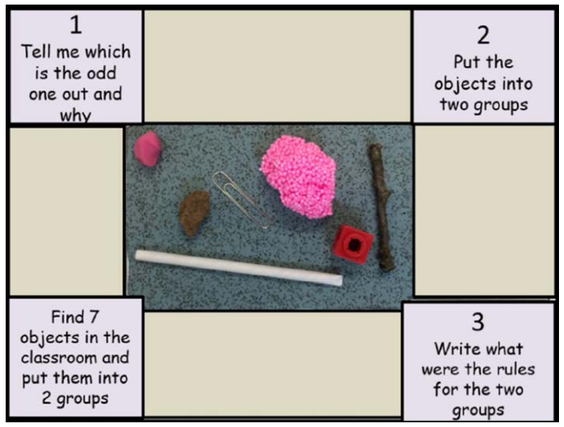


Fig. 21. Frame to support children to explain simple patterns, giving reasons for their suggestions (for ages 6-7)

Things to note:

- the Frame helps focus attention on the objects in the middle
- the questions are 'open ended' and encourage language and reasoning
- as well as supporting children's learning, developing the Frames helped me to focus on skills and task progression in lessons and identifying next learning steps

Sam Kenny is a teacher at Bethlem and Maudsley Hospital School in south London. Sam is a Fellow of the PSTT Teacher College, having won a Primary Science Teacher Award in 2008. Sam has also received a 2019 Inspirational Educator Award from the Worshipful Company of Educators in 2019. This award was given for his 'innovative and highly personalised programme in science for children with acute psychiatric needs'.

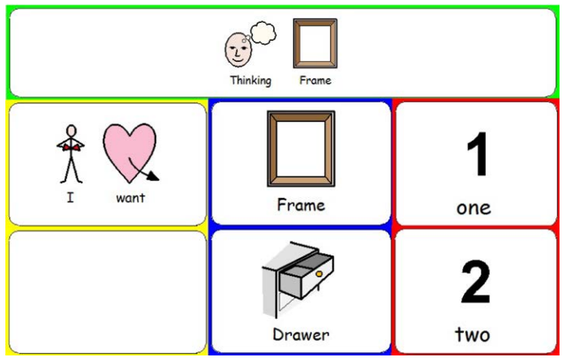
Greg's Story
Process and Progress

Greg Mace

Athelney Primary School

I work within an Autism Spectrum Disorder (ASD) Resource Base for primary age children ranging from 5 – 11 years old. The facility is based within a mainstream school. It provides an extra layer of resourcing to enable the young people who use it to access the curriculum and build skills and strategies to support their integration into their mainstream classes.

I have used the Frames approach to help the young people that I work with to attend better to learning tasks, to track their science thinking, to make progress towards their learning goals and to develop more independence. Using the Frames has also helped me to clarify my own thinking when planning and preparing lessons.



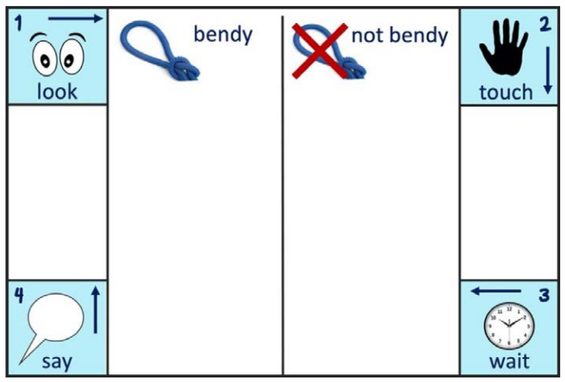


Fig. 22. Early years and foundation stage (EYFS) children used this Frame to explore pairs of objects.

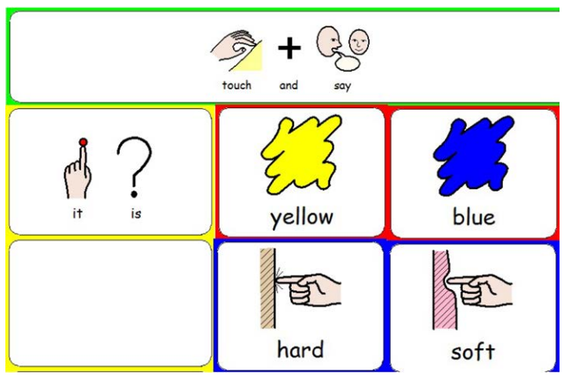


Fig. 23. Communication support boards were created to be used alongside the Frame.

As well as guiding thinking, the Frames also enabled my children to be more ready to learn. If you'll pardon the pun – they get the children into the right frame of mind and help them to be more emotionally switched on to learning.

The Frames:

- reduce cognitive load, acting like a task-board that can be referred to – to help children catch and keep the thread of the task
- are appealing to look at and stand at odds with busy worksheets or investigation proformas
- are easy to use as the children move from signpost to signpost. These signposts can be numbered and ticked off giving the children a sense of progression and pride, and the end is always in sight
- become a kind of ritual once children are familiar with them and are valued as a steppingstone to success as well as boosting confidence and developing independence

Over the past five years I have used Frames in a wide variety of contexts from concept acquisition for children with limited language to challenging the thinking of greater depth children in the upper primary age range.

The Frames approach is firmly embedded within the ASD Resource Base, and it is also used by teachers more widely across the school. Children can take familiar Frames from the resource base with them when they go into their mainstream class.

The Frames approach has wider benefits for my practice as it:

- prompts me to consider more carefully what thinking and learning I want my children to participate in
- helps me to make tasks concise, my questions valuable and my line of enquiry clearer
- reduces planning time as the Frames are simple and quick to make
- makes differentiation very easy

Greg Mace is teacher at Athelney Primary School in south London, and manager of the school's Resource Base: a separate provision for children with additional needs. Greg is a Fellow of the PSTT Teacher College, having won a Primary Science Teacher Award in 2013.

Rob's Story
Reflecting and Refining

Rob Floyd

Rowan School

I work in a primary school for children with autism. I was interested in the action research approach of the Primary Science for All project. My contribution to the project has been supported by the workshops, an ongoing WhatsApp group chat, lectures, co-coaching and most importantly for me time to stop and think!

Fig. 24. The Rowan School Wonder Cupboard

I am particularly interested in the idea and application of a Wonder Cupboard for promoting science and as a tool for de-escalating behaviour. I set up the Wonder Cupboard for my school. It has been a challenge to set up a cupboard of wonderful and interesting objects for primary-aged autistic children from a middle-aged non-autistic perspective. Through trial and error, I refined the cupboard and the contents. This has empowered me to feel as though I am driving this project forwards into new territory. To begin with I chose objects that I thought would be interesting, like the graphics card of a PC, but observed that the children were far more interested in objects like an old-fashioned dial telephone. This led me to the idea of recording how the Wonder Cupboard was being used so that I could monitor which items were of interest and which were not. Without realising I had embarked on my own action research project!

Date	**Purpose of visit to the Wonder Cupboard** Code: **D** De-escalation **W** Wonder	**Visit initiator:** Code: **C** Child requested to use **A** Adult suggested to use	**Object chosen**	**Impact Code: S** Successful **U** Un successful	**Evidence of impact** *Pupil response or staff observation e.g: Pupil expressed interest/attention for 5 minutes, pupil calmed, pupil stated "everything is boring in here".*

Fig. 25. Data collection tool. Why are children visiting the Wonder Cupboard and how are they using it?

I left the data collection sheet in Fig. 24 in the Wonder Cupboard for other teachers, TAs and children to record their experience of visiting the cupboard. Their responses enabled me to collect data about the purpose of the visit to the Wonder Cupboard, the items chosen by children, and what the impact was of the children engaging with the object. The data I gathered has shown that after starting as an adult-initiated activity, some children are beginning to request to use the cupboard as tool for de-escalating and self-regulating their mood and behaviours.

This resource has been invaluable in supporting our children with managing their own emotions in a positive and learning focused manner. It is a very child-centred and enabling tool for behaviour management.

Rob Floyd is a teacher at Rowan School in Sheffield. The school offers nurturing and individualised provision for children with autism.

Anita's Story
Leading Change Across the School

Anita Huckerby

Totley Primary School

I am a lower primary-age teacher and science leader in a mainstream primary school. I jumped at the chance to be involved in Primary Science for All because it was an opportunity to innovate and collaborate with teachers beyond our school. I started by using the Frames and Wonder Cupboard in my classroom, and this led the development of these inclusive approaches across school.

The Wonder Cupboard

Firstly, I introduced the Wonder Cupboard to my class of five and six year olds. I set up a small cupboard in our science 'Investigation Station'. I filled it with objects linked to our topic on invertebrates including a snail's shell, some plastic insects, a wooden 'wiggle bug' and leaves from the school grounds. The cupboard created a real buzz in the classroom. Children were questioning me, and each other, about it... Why was it there? Were they allowed to touch it? What was it for? We talked about the Wonder Cupboard and how we were going to use it. The children could touch the items, but they had to be careful. Question stem cards were placed around the cupboard as prompts. The children recorded their questions, or ideas stimulated by the cupboard's contents.

By the end of the week our display was covered in questions and facts that the children had researched. Children became co-curators of the cupboard. They brought in objects and drawings and explained why they merited a place in the cupboard. The children's questions and items were then incorporated into our science plan and activity.

Frames

I introduced a Frame to support the exploration of items in the cupboard. Children selected an object and placed it in the Frame. I worked with small groups to observe how individual children interacted with a Frame. All the children were able to access them. Some children took control of the Frame while others required adult or peer support. Children responded well to the clear structure and layout, which seemed to reduce anxiety about the expected outcomes. The blank Frame was less scary than a blank sheet of paper!

As the Primary Science for All project progressed, I adapted the Frames. I took inspiration from the other project teachers and experimented with colour, numbered boxes and post-it notes to cover and reveal questions one at a time.

Introducing the Wonder Cupboard and Frames across the school

After success in my class, I worked with staff to set up a school 'Wonder Cupboard' which was launched by the science ambassadors during Science Week. Each teacher had a class box. They filled it with items to act as a hook for Science Week themes. There was a great balance between items chosen by the children and teacher-curated resources, with all of them helping to develop science talk, questioning and understanding.

During and after Science Week I collected feedback from staff and children. Responses to a staff survey indicated that the children enjoyed using the cupboard. However, we need to do more to ensure we know the resource is supporting science learning.

I also introduced the idea of Frames to staff, and they have been developed by teachers across the school to chunk the investigation process into small steps and to develop science concepts. I gathered feedback on the Frames from the staff and children. Teacher survey responses suggested that most children can access the resources independently. Teachers felt that the Frames were effective in supporting progress in children's scientific concepts and promoting children's scientific enquiry skills. Feedback from the children indicated that they enjoy using Frames because they are easy to understand, break learning down into small steps and help them to retain information.

Anita Huckerby is a teacher and science subject leader at Totley Primary School in Sheffield.

Why not try one of the Inclusive Approaches for Primary Science?

The Primary Science for All project was about developing inclusive approaches and resources to meet the needs of individual children. We have shared some ideas and you can develop the approaches for your children too!

Wonder Cupboards can be used to:

- provide a focus for your topic with items and question stem prompts for exploring the items
- stimulate curiosity, exploration and questioning
- house and value topic related items collected by the children

Developing your own Frames can help to:

- refine your ideas and be clear about the learning outcome you are aiming for
- focus on the concept or skill to be developed.
- plan and sequence small learning steps
- think carefully about the stimulus – What should go in the middle of the Frame?
- think carefully about questioning – Which questions will scaffold thinking?
- break down the process into clear manageable stages to reach the outcome. These will be on the corners of your Frame

We are always interested to hear and see how people have used the Wonder Cupboards and Frames. If you have tried out any of the inclusive approaches, please do let us know by contacting Joelle Halliday on j.halliday@shu.ac.uk

References and Further Reading

Education Endowment Foundation (2020), Special Educational Needs in Mainstream Schools: Evidence Review

Mcleskey, J. et. al. (2017), High-leverage Practices in Special Education, Council for Exceptional Children and Ceedar Centre

Mitchell, D. (2014), What Really Works in Special and Inclusive Education: using evidence-based strategies, London: Routledge. NB this book is now out of print, but a preview pdf download is available through the link on the Taylor Francis webpage

OFSTED (2021) Research and analysis: Supporting SEND

The Primary Science Teaching Trust (2014), Cambridgeshire Science To Raise and Track Achievement in Science project (STRATA): Supporting pupils with special educational needs or disabilities (SEND) in science

Training and Development Agency for Schools (2009), Special Education Needs and/or Disabilities Training Toolkit

Imagine a great primary science lesson. What would children be doing? How would they be thinking and feeling? Everyone's image may be different but there would probably be some common features including a vibrant environment where children are actively engaged in developing their science knowledge and skills to find answers to their own questions. Children may be exploring, observing, predicting, collecting data, looking for patterns and drawing conclusions. But for some children the 'buzz' of the primary science classroom can be challenging.

The Primary Science for All approach, led by Sheffield Hallam University, responds to challenges for children with diverse needs. The project team has developed resources to support these needs. This guidebook introduces these resources and outlines how teachers and teaching assistants can incorporate them into their school's approaches to teaching and learning in science.

What teachers say about the inclusive approaches in this guidebook

"One child in the group really struggles with focus and attention, and we've noticed using the Frames is definitely helping him."

"One of my children actually turned around and said, 'Well, I know what to do next.' So it's helping him to be a bit more self-directed and helping him to feel a bit more in control."

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