Primary Science

Special Issue: Teacher Assessment in Primary Science (TAPS)

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The Association for Science Education

The ASE's journal for primary science

why & how? Primary Science Teaching Trust

Bath Spa University Institute for Education

special issue: TAPS

Contents

Primary Science

Special issue

Editor *Dr Leigh Hoath*

Focus on…

TAPS Special issue

Rarely do we have the opportunity to share with teachers resources that are not only effective, supportive and view-changing, but are also free. The wealth of knowledge that underpins Teacher Assessment in Primary Science (TAPS) is, without exaggeration, phenomenal. The resources, which are constantly developing and growing, are accessible, usable and ultimately very useful. It is a real bounty that has been made available to teachers through this resource.

This special issue demonstrates quite clearly the difference that TAPS has made to the professional lives of a large number of teachers. I work with many in-service teachers and assessment in science remains one of those areas that we visit and revisit… nothing seems to quite 'fit' for science. I am not going to say that TAPS is everything to all… but it is a large step in the right direction. There is flexibility within the resources for moulding to your own school and setting. There is scope to adapt and change, extend and apply, move lesson plans around and make their great ideas even better.

Read the articles… see for yourselves the benefits there are in engaging with science assessment in this way. Make use of the experiences of others and take the next steps to more effective assessment of science in your own school.

My thanks go to Sarah Earle, TAPS project lead and Senior Lecturer at Bath Spa University, for her hard work guest-editing this special issue, and to all the contributors who have provided such insightful articles.

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The Association for Science Education

Introduction to the TAPS special issue of *Primary Science*

Sarah Earle introduces TAPS and this special issue of Primary Science

The Teacher Assessment in Primary Science (TAPS) project is funded by the Primary Science Teaching Trust (PSTT) and based at Bath Spa University (BSU). It began in 2013 with the aim to develop support and guidance to enable teachers to assess primary science in a way that would be as valid, reliable and manageable as possible. TAPS resources are placed on the PSTT website: **https://pstt.org.uk/resources/curriculum-materials/assessment** and new resources will continue to be added. This special issue of *Primary Science* is designed to bring together a range of perspectives on the TAPS resources and how they are being used to support teacher assessment in different contexts.

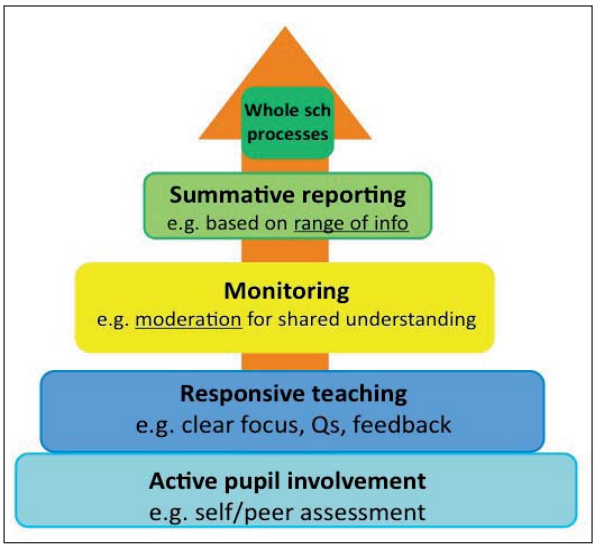
In its first year, the research team and project teachers operationalised a model of teacher assessment put forward by a group of experts convened by the Nuffield Foundation (2012), and created the TAPS pyramid model for school self-evaluation. The key principles version of the TAPS pyramid (see Figure 1) shows how classroom assessment information (the blue layers at the base of the pyramid) can be summarised for reporting purposes (the green layers), moderated by the middle yellow layer. The article by **Bethan Jones, Ruth Coakley, Lisa Fenn** and **Dan Davies** will explain the TAPS pyramid model in more detail and consider how TAPS Cymru is utilising it to support school self-evaluation of teacher assessment in Wales. **Isabel Hopwood-Stephens** will consider the dissemination of the TAPS pyramid and how a sample of teachers describes its use.

At the centre of the TAPS pyramid is a 'shared understanding' box, which has been a key area of development for many schools. **Carol Sampey** explains how a shared understanding of science has been developed in her school, whilst **Pauline Rodger** describes how moderation activities have been used to develop a shared understanding of assessment.

However, many schools find it difficult to begin a discussion about assessment in primary science and, more recently, we have found that 'Focused Assessment' is a 'way in' for schools where there is not yet a shared understanding. **Kendra McMahon** explains the Focused Assessment approach and how it can support assessment of scientific enquiry. **Kerry-Anne Barber** describes how Focused Assessment has been used as part of a whole school approach to assessment. **James Mepsted** explains how he first raised the profile of science enquiry, before then rolling out a Focused Assessment approach to assess 'Working Scientifically'. In the final article, **Asima Qureshi** and **James Petrucco** consider how TAPS Focused Assessment can be used to support transition at the beginning and end of the primary school. 'TAPS Transition' is one of the current areas for research, together with exploration and development of TAPS for Northern Ireland (2017-18) and Scotland (2018-19).

Key to TAPS is the collaboration between researchers and teachers to develop support that will have an impact on practice. It is hoped that the many voices in this special issue provide an insight into the ongoing work of the TAPS project.

Figure 1 Key principles version of the TAPS pyramid model)



Sarah Earle is TAPS project lead and Senior Lecturer at Bath Spa University.
Other members of the BSU TAPS team include Kendra McMahon, Alan Howe and Chris Collier.

See Sarah and others explain the TAPS approach here: **http://tinyurl.com/TAPSplaylist** and the resources available here: **http://tinyurl.com/TAPSsupport**

Teacher Assessment in Wales – the TAPS Cymru Project

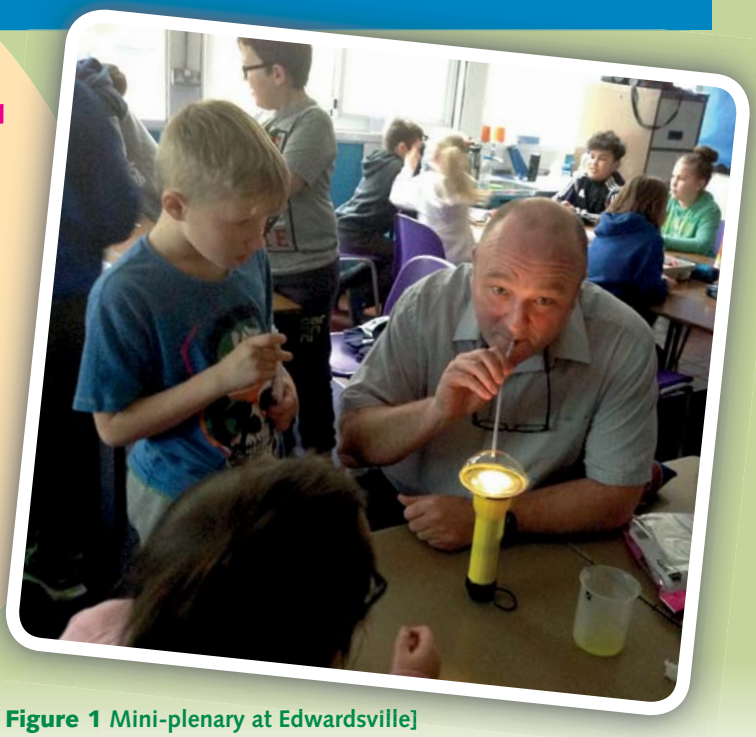


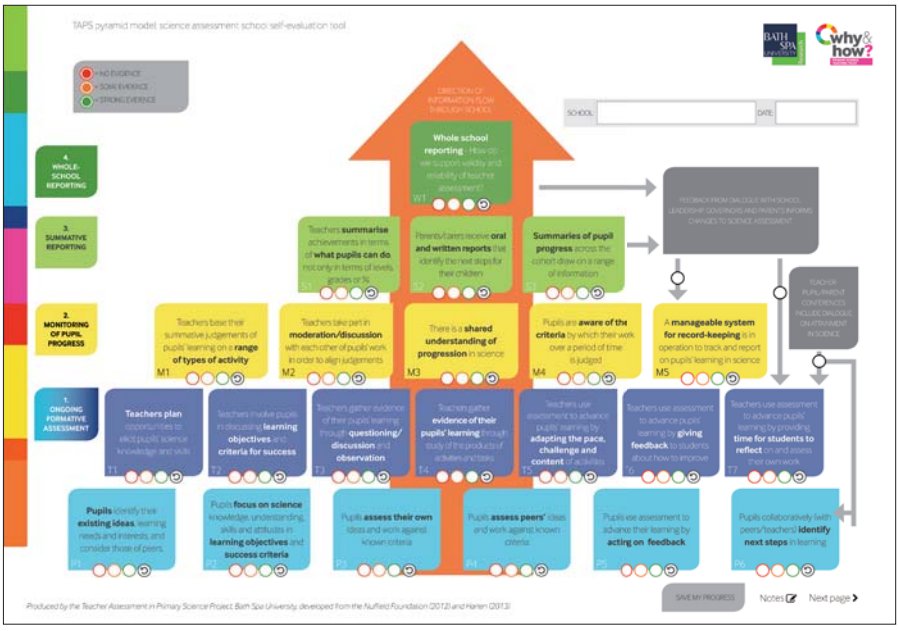
Figure 1 Mini-plenary at Edwardsville]

Bethan Jones, Ruth Coakley, Lisa Fenn, Sarah Earle and Dan Davies show the versatility of the TAPS project and how it can be aligned with more than the National Curriculum for England

Introduction

Making accurate, manageable assessments of children's scientific understanding, skills and progress is one of the biggest challenges facing primary teachers. In Wales, where Statutory Assessment Tests (SATs) at age 11 were phased out in 2005, teacher assessment has been the only source of pupil attainment data in science for a much longer period than in England, which has necessitated the development of cross-phase moderation and a greater use of e-portfolio systems such as *Incerts* to track children's progress. Nevertheless, the primary science team at Cardiff Metropolitan University felt that teachers in Wales would benefit from the approaches to classroom and whole-school assessment developed by the Teacher Assessment in Primary Science (TAPS) project at Bath Spa University between 2013 and 2016, particularly the 'pyramid self-evaluation tool' (see Figure 2), which helps schools to recognise their strengths and weaknesses in teacher assessment, and the Focused Assessment tasks available on the Primary Science Teaching Trust (PSTT) website (see **www.pstt.org.uk**). Because the education system in Wales has diverged from England since devolution, including the introduction of a new 5-16 *Successful Futures* curriculum (Donaldson, 2015), which groups science with technology into a single 'Area of Learning and Experience' (AoLE), we wanted to see whether the TAPS project resources would work in a Welsh context. Specifically, our aims for the 'TAPS Cymru' project were to: validate and adapt the 'pyramid self-evaluation tool' to be used in primary schools in Wales, including translation into Welsh and the provision of Welsh examples to accompany the online version of the tool on the PSTT website; and trial some of the TAPS Focused Assessment tasks in Wales and develop some new tasks for assessing children's science and technology learning in the new *Successful Futures* curriculum.

Figure 2 TAPS pyramid self-evaluation tool



The TAPS pyramid self-evaluation tool

The TAPS pyramid school self-evaluation tool provides a framework to support science subject leaders in identifying strengths and areas for development in school assessment systems. It is based on an analogy between the flow of assessment data in a primary school and the flow of energy between levels of a 'pyramid of biomass' in a biological ecosystem, developed by Harlen *et al* (2012). This flow of information is represented by the orange arrow on the TAPS pyramid. The blue 'Pupil' and 'Teacher' layers at the base of the pyramid encapsulate the principles of Assessment for Learning (AfL). They include boxes that focus on: clear learning objectives or success criteria; use of questioning, feedback and next steps; and peer- and self-assessment. The yellow 'Monitoring' and green 'Summative Reporting' layers concern the systems by which AfL data are summarised to track pupil progress and report on it to parents and carers, the next teacher and external stakeholders. The suggestions in each box, which are supported by examples in the online version of the tool, aim to strengthen the validity, reliability and manageability of these systems, and can be used by schools to benchmark their own approaches to teacher assessment in science.

Working with primary schools in Wales to develop TAPS Cymru

We worked with six 'project schools' – two of which were Welsh-medium – and five 'associate' schools:

- **Blaenycwm Primary School, Brynmawr, Blaenau Gwent**
- **Coed y Gof Primary, Cardiff**
- **Edwardsville Primary, Merthyr Tydfil**
- **Fochriw Primary, Caerphilly**
- **Garnteg Primary, Pontypool**
- **Marlborough Primary, Cardiff**
- **Pencae Primary, Cardiff**
- **Penllergaer Primary, Swansea**
- **St Fagans Primary, Cardiff**
- **St Paul's Primary, Cardiff**
- **Tongwynlais Primary, Cardiff**

During three 'cluster days' in November 2016, March and June 2017, we introduced co-ordinators and class teachers for science, design & technology and computing (the subjects making up the new science and technology AoLE) from the above schools to the pyramid self-evaluation tool and asked them to use it to evaluate teacher assessment in their own schools. Their judgement was that, despite the tool having been developed within an English context, it accurately describes best practice in teacher assessment in Wales and can be used to evaluate and improve their own schools' systems and approaches with little adaptation. During Cluster Day One, they experienced and adapted existing TAPS Focused Assessment tasks, before trialling them in their own classrooms between Days One and Two. During Day Two, they planned and developed new 'science and technology' tasks for sharing on Day Three. Between cluster days, university staff worked with participating teachers in their classrooms to trial the new and existing tasks, and to identify examples of best practice to illustrate the 'boxes' in the pyramid tool. These will be incorporated into the online version of the tool to ensure that it represents teacher assessment practice in England and Wales.

TAPS pyramid examples from Wales

Altogether, the TAPS Cymru schools have generated over 70 examples of excellent practice in primary science teacher assessment to illustrate boxes at all levels of the TAPS pyramid. These will be made available on the PSTT website; here are a few 'sneak previews':

Pupil voice at Pencae (Pupil layer)

At the start of a topic at Ysgol Pencae, pupils identify their current ideas and raise questions to lead the learning during the topic. For example, in Year 1 the class teacher records pupils' questions on a Pupil Voice Wall (Wal Llais Plant – see Figure 3; also http://tinyurl.com/TAPSpencae). During lessons, the teacher refers back to the Pupil Voice Wall to show how the pupils' questions are being considered. In Key Stage 2, pupils complete KWL grids to consider what they Know, Want to find out and, at the end, what they have Learnt.

Year 1 pupils at Pencae engaged with a series of bridges activities for their science and technology Focused Assessment task. This ensured that pupils were clear about the focus on science knowledge and their understanding and skills were developed. During an initial whole class carpet session the class explored and discussed pictures of different bridges, which helped them to understand the purpose of a bridge and also supported the development of their scientific vocabulary. Many pupils adopted the various names of the bridges (*trawst, bwa* and *consertina*). One group worked with the teaching assistant in the outdoor forest area of the school, hunting down suitable natural resources with which they experimented, and used the most appropriate to construct bridges. Pupils were clear about the design structure and, through trial and error, everyone succeeded in building a bridge. The teaching assistant recorded the work through photographs.

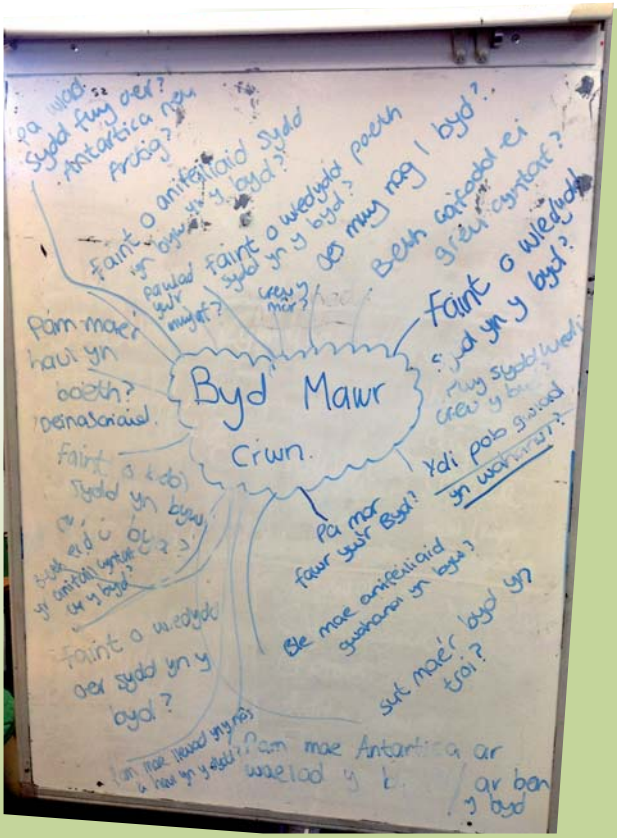


Figure 3 Wal Llais Plant at Pencae (Pupil Voice Wall)

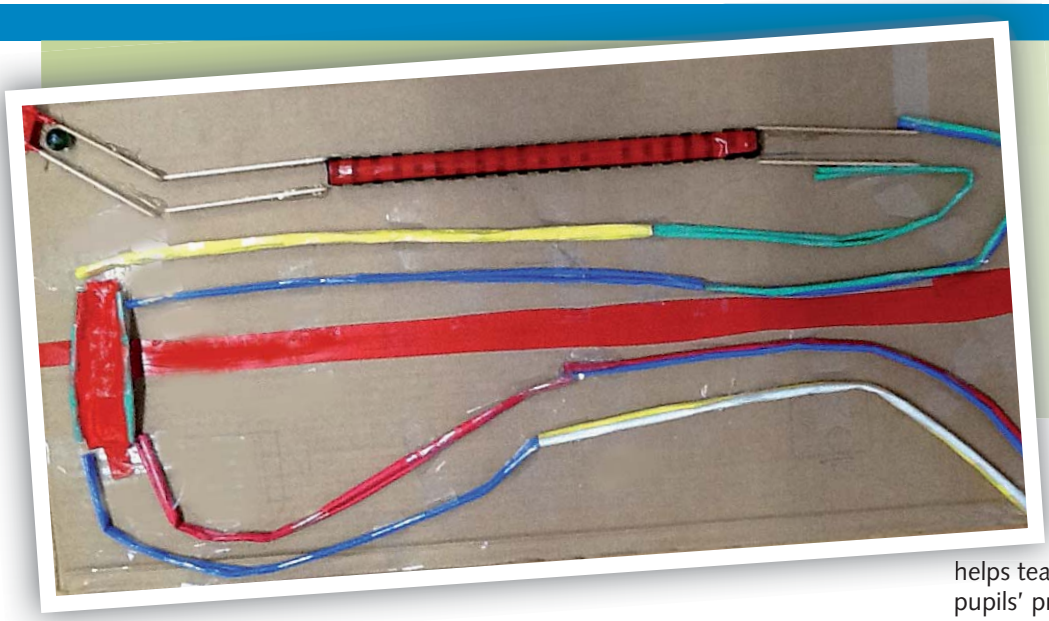


Figure 4 Marble run at Tongwynlais

Use of mini-plenaries and on-the-spot feedback at Edwardsville (Teacher layer)

Pupils have an increased chance of meeting their learning objective when presented with an opportunity to learn from a mini-plenary. The focus of this lesson was that pupils asked questions about light and decided on a line of investigation. The teacher adopted the use of mini-plenaries at pertinent points during the lesson to help the pupils to progress. At the start of the lesson, only a small number of pupils successfully 'created' bubbles; however, it was evident after each mini-plenary that more children were able to create a bubble. This is an example of a teacher adapting the pace of the lesson to enable all learners to achieve (see Figure 1).

A further example was seen within a science and technology Focused Assessment task, where teacher feedback was successful because it could be acted upon immediately. The focus of this lesson was for pupils to design the most effective packaging to ensure that eggs would not be broken when being taken to market. The teacher gave pupils feedback about how to improve during the lesson. For example, one group of children were refocused from the landing surface to the package development. Another group had forgotten that the package would actually need to open to hold the egg. Both groups of pupils listened to feedback and produced a more effective package.

Summative judgements based on a range of activity at Tongwynlais (Monitoring layer)

Summative judgements can be more valid if based on a range of information. At Tongwynlais Primary, the science subject leader ensures that 'rich science activities' are recorded through a class floorbook, particularly within the Foundation Phase. The floorbook can include electronic annotations (e.g. pic-collage) or handwritten notes of the children's utterances during investigations. End-of-topic judgements can be informed by a range of activities during the topic. For example, Key Stage 2 pupils were asked to design and make their own 'mail run' (marble run – see Figure 4). They were asked to design a bridge, tunnel and pathway resulting in a final product. They had to decide which materials and tools to use. Next, the teacher asked them to evaluate their work, reflecting on the functionality of their prototype, what worked well, what did not go well and what they would do next time. Analysis of these activities enabled the class teacher to make a summative judgment on a variety of scientific skills.

Passing on information to the next teacher at Garnteg (Summative Reporting layer)

Moderation can be useful for more than checking judgements of pupil outcomes. By taking part in moderating discussions, teachers can develop their understanding of progression and assessment. At Garnteg Primary, each class teacher brings examples of children's work from their termly enquiry to a whole school staff meeting, where teachers work in pairs to moderate and agree the judgements (for more information, see http://tinyurl.com/TAPSgarnteg). Other pairs then make suggestions for next steps that could progress the pupil's learning. After 'RAG-rating' each child's progress, interviews are conducted with teachers of underachieving children to establish what support should be put in place. Pupil books are passed on to the next class teacher at the beginning of a new school year. This process helps teachers to be informed of the pupils' prior learning. Teachers carry out a handover session at the end of each school year with the new teacher, discussing the children's prior attainment and pastoral information.

Conclusion

These assessment examples from Wales have greatly enriched the database of good practice to support schools in using the TAPS pyramid self-evaluation tool. The wealth of teacher assessment experience developed in Wales over the past decade – for example, in cluster moderation and the use of e-portfolio tracking systems – should be disseminated across the UK, together with the new approaches to child-led enquiry and science in technological context that are being encouraged through the *Successful Futures* curriculum.

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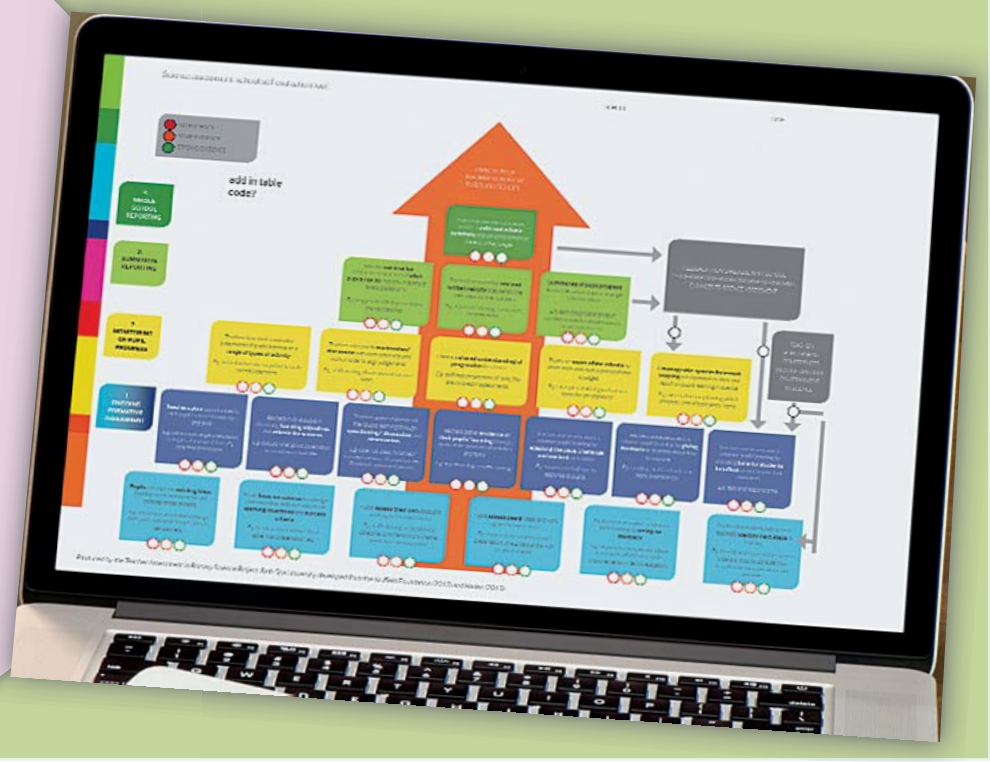
Bethan Jones, **Ruth Coakley**, **Lisa Fenn** and **Dan Davies** were based at Cardiff Metropolitan University at the time of the TAPS Cymru project. **Sarah Earle** leads the TAPS project.

See Bethan explain the TAPS Cymru project here: http://tinyurl.com/TAPScymru and Dan discuss how TAPS can support assessment in Wales here: http://tinyurl.com/

The TAPS pyramid: where, who and how?



Isabel Hopwood-Stephens outlines the success of TAPS through the exploration of their data

Introduction

The TAPS pyramid was developed in late 2014 and has been available as a download on the Primary Science Teaching Trust (PSTT) website since August 2015. But where has it gone since then? Who is using it? And how is it being used in schools to change primary science assessment practice?

This article will attempt to answer these questions with data from an ongoing study into its impact and reach.

Where has the TAPS pyramid been downloaded?

During its first year online, the TAPS pyramid was downloaded 2,994 times (see Figure 1), from Taiwan and Tanzania to Cyprus and Singapore. However, international downloads account for only 5% of the total; the vast majority of downloads took place in the UK. It was downloaded in 362 different locations, from 537 copies in London to one copy in Leek.

The TAPS pyramid was not only disseminated online, however. It was also presented to science subject leads and primary teachers at conferences, seminars, cluster meetings and staff development days. These events, led by primary science specialists who are passionate about improving

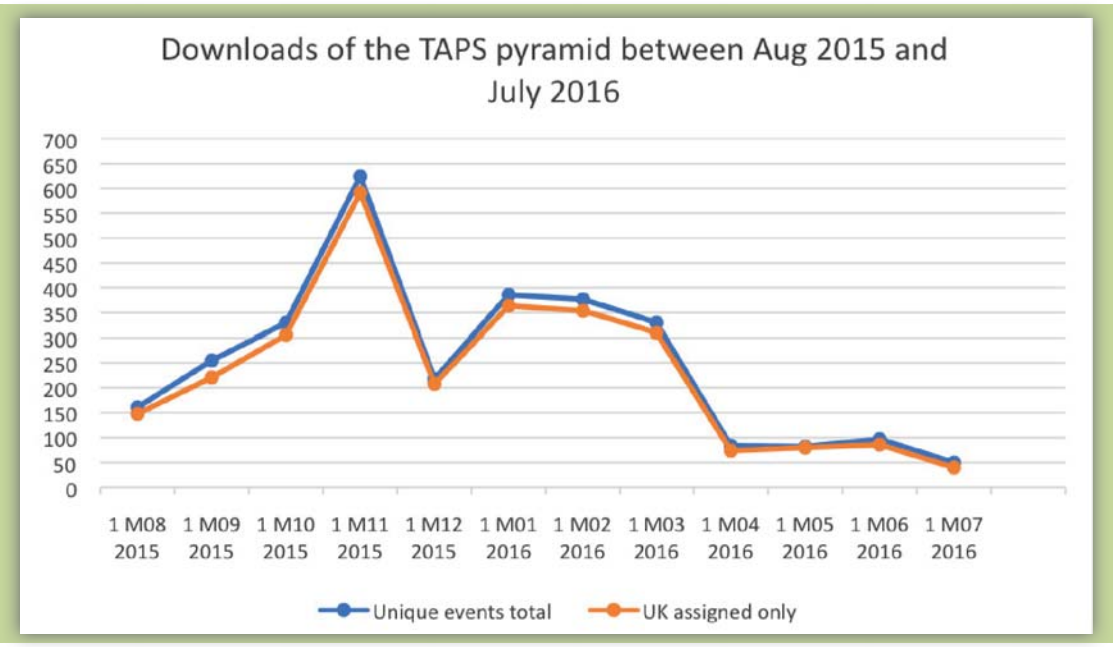


Figure 1 Monthly downloads for the first year online

their subject, played a vital role in bringing the TAPS pyramid to its target audience. Put simply, there were significantly more downloads of the TAPS pyramid in counties where these types of events to promote the TAPS pyramid were held, compared to those where there were none. Perhaps this is not surprising – after all, the TAPS pyramid is not an 'off the peg' solution for primary schools wishing to improve assessment in primary science! Instead, it is a resource that requires its user to engage with it. These events allowed interested teachers and subject leads to learn about this new resource, and also to reflect upon how to adapt it to the requirements of their settings (King, 2003).

Who used it, and how?

The TAPS pyramid user survey used an online questionnaire (December 2016-February 2017) to collect the views of over one hundred teachers, science subject leads and school leaders who had tried using it in their schools.

Interestingly, the mode through which respondents discovered the TAPS pyramid seems to have shaped their understanding of its purpose. 50% of those who discovered it at an event thought that it was for evaluating existing primary science assessment practice, compared to only 13% of those who found it online. This difference can also be seen in how respondents reported using it; those who discovered the TAPS pyramid at a face-to-face event put it to a considerably wider range of uses than those who had discovered it online. This finding indicates that a deeper understanding of its purpose and possibilities was gained by those attending the dissemination events.

Increased use of formative assessment

At an individual level, the TAPS pyramid has overwhelmingly been used by respondents to evaluate and improve how they assess progress in primary science. Three quarters of respondents used the activities in the blue pupil and teacher layers to increase their repertoire of formative assessment strategies, and many respondents felt more confident about assessing pupil progress due to using a wider range of formative assessment strategies. The most challenging aspect of using the TAPS pyramid for individual teachers seemed to be the storage of all the rich formative data being generated by these changes to their practice; one quarter of respondents said that they had not yet established a manageable system for keeping and using that data.

However, it wasn't plain sailing for all teachers who tried to use the TAPS pyramid. When asked how satisfied they had been with how they had used it, the main reason for being dissatisfied was having insufficient time to work out how to use it. This was followed closely by a lack of support from the school leadership. A few respondents also found it hard to understand.

Changing assessment at a school level

At a school level, the TAPS pyramid has been used in primary schools to raise awareness of appropriate formative assessment strategies, with science subject leads evaluating existing assessment practice in their schools before delivering tailor-made professional development for staff. An interesting shift can be seen in these schools' assessment practice: 55% of respondents said their staff now collect evidence from a range of sources for judging pupil progress, and 52% reported that their staff now have a shared understanding of what progress in the science topics looks like.

The toughest nut to crack seems to be moderation, however. Just under half of all respondents who had used the TAPS pyramid to change assessment practice at a school level admitted that they were yet to hold a moderation meeting.

Reasons to be cheerful

A key difference between the school level findings and individual use was the most frequently cited reason for satisfaction. While individual users ascribed their satisfaction to their increased confidence and range of assessment strategies, the most frequently cited reason for school-level satisfaction was the opportunities that the TAPS pyramid provided for discussing primary science teaching and assessment with colleagues. When added to the fact that the highest downloads occurred in areas with face-to-face events, and the link between discovery and interpretation, these results seem to support the view that teachers prefer to learn from their peers (Hood, 1990). This in turn validates the 'cluster' model for disseminating new ideas and practice among primary teachers (Primary Science Teaching Trust, 2017).

Study limitations

This survey collected the views of a self-selecting sample of teachers who were already interested in primary science assessment. While these data indicate how the TAPS pyramid has influenced assessment practice in primary schools, little can be learned from this analysis about the experience of ordinary class teachers who had to change their assessment practice. Equally, little can be understood of what it was like for teachers and subject leads whose attempts to shift assessment practice using the TAPS pyramid stalled. The final stage of this study will use case study data to explore in more detail how teachers change their practice at an individual and school level. In the meantime, the TAPS pyramid can be downloaded from the PSTT website.

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How was your experience of sharing the TAPS pyramid in your school? If you would like to participate in this study, please contact the author at ***i.hopwood-stephens@bathspa.ac.uk***

Isabel Hopwood-Stephens is an Associate Lecturer and Doctoral Researcher at Bath Spa University.

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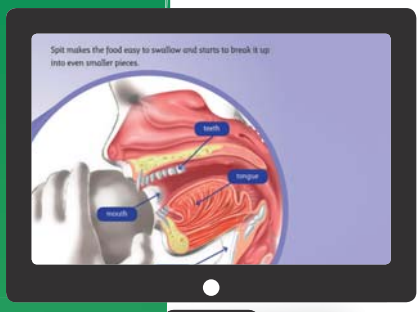

"The treasure trove of online videos, animations and interactive activities really help to engage pupils and bring the scientific concepts to life." – Teach Primary

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evaluated

Making more effective use of moderation

The children engage with enquiry and record their work using iPads

Pauline Rodger from Holt Primary School discusses how moderation of working scientifically is developing in her school

Our context

Holt Primary School is a village school in which teachers work as a team within a climate of respect and trust. We were fortunate to take part in the Bath Spa TAPS (Teacher Assessment in Primary Science) research project, which also overlapped with undertaking Gold PSQM (Primary Science Quality Mark). As a result, teacher confidence in facilitating practical, child-led enquiry and pupil engagement in science increased, enabling us to trial and develop school-wide systems for assessing and tracking pupil progress. We used the TAPS pyramid to audit our assessment strategies, at both class and school level. Adopting a range of Assessment for Learning (AfL) strategies was at the centre of our school-wide development. As a result of this, we found that we were no longer reliant on bolt-on summative assessment systems, as we were more familiar with the curriculum and aware of progression, and so were ready to begin moderating to validate assessment judgements and ensure consistency across the school. Prior to this developmental work, moderating activities had little significant impact and were often perfunctory, providing little critical feedback.

How moderation began in our school

We held termly staff meetings in which, initially, teachers brought along their own choice of pre-assessed examples of work to discuss – we recorded our responses on a given format. The open choice helped to instil confidence and ensured that the work came out of what was being studied and not something specifically created. This progressed to bringing fewer, but specific, examples pertaining to a pre-decided subject, skill or year group focus and became an addition to other staff meetings. The work samples could be concept-based or working scientifically; making a clear distinction between these was the first step in raising awareness of the need for smarter, focused planning of learning objectives, assessment criteria and therefore more effective moderation. Based on the principle of pair and share, teachers were asked to discuss their samples of work and then present to the whole group. At this stage, it was very much about 'talking science', evaluating resources we used to inform judgements and identifying what the challenges were. Typical questions were: how had the teacher arrived at the judgement, do we all agree and understand the judgement and how do we resolve issues of difference? These professional discussions were beneficial on so many levels in supporting our teaching and assessment practice as well as developing consistency in judgements.

Many discussions related to how to we interpret children's responses differently: what of the mismatch between what we think we know that children are understanding and how effectively they communicate that for assessment purposes and, therefore, how reliable it is for moderation of professional judgements. We recognised that objectivity was difficult if each piece of work needed to be accompanied by a teacher's verbal or written annotation, and also if we have a vested interest in ensuring that moderation validates our judgements for assessment/tracking purposes. For example, child A and child B had been working on the same friction activity and, in their recorded work,

child A had stated that *'the car went the fastest on the wood because there was less friction'*, but child B stated that *'the car on the carpet lost because the carpet slowed it down because it was sticky'*. We discussed whether there was a difference in the understanding shown here – which, if either, shows better understanding, and what part does vocabulary and any conversations the teacher had with them play? This was about 'drilling down' and identifying precisely what a child understood and could communicate; and also about how well teachers understood the concepts. As moderators, we needed to know how the teacher arrived at her judgement, and the professional learning point was clarity of learning objectives and knowledge of success criteria.

The children focused on working scientifically

As a subject leader, these sessions provided insight into further areas for CPD and identified a need to agree resources that would support our judgements:

- **The Collins Snap Science scheme: straightforward guidance for making judgements.**
- **The National Curriculum, Interim Teacher Assessment Frameworks and STA exemplification.**
- **ASE's PLAN resources: annotated collections of children's work.**
- **CIEC Working Scientifically: Assessment and Progression of Enquiry Skills.**
- **TAPS Focused Assessment database: plans and examples.**

By agreeing a 'go to' core of reference documents, teachers felt more in control and clearer about moderation requirements.

Developing moderation as a cluster

We have started to test our judgements through cluster moderation – nerve-wracking, but essential – facilitated by being part of a Learning Collaborative, where science subject leaders from several local schools meet. Initial cross-school moderation took place in term 5 to impact the validity of end-of-year assessments, but now happens on a more regular basis. This proved hugely beneficial for us all, each of us being at different stages of the process. It raised much useful discussion and offered new ideas for dealing with common issues. A Year 6 (age 11) example of cross-curricular work proved contentious: a super explanation text (met Year 6 writing objectives) of how to make a simple circuit, but the science content was not meeting Year 6 objectives for electricity – only managing a Year 4 (age 9) level.

As we looked at different presentations of work from across the schools, it was apparent that it was difficult to moderate judgements with efficiency and confidence – we needed to see 'what a good one looks like'. Alongside the National Curriculum, an excellent resource that we used was PLAN, the ASE exemplification materials. One school had replicated the work of 'Julie' in the Year 6 electricity file – to try to ensure that her pupils demonstrated 'expected'. This was a useful place to start if it supported the teachers in gaining insight and understanding of the detail of the requirements. To facilitate greater success at subsequent meetings, a proforma has been developed so that teachers bring a range of pre-assessed and pre-moderated work to the meeting, which can then be discussed, annotated, copied and returned for dissemination in schools cross the cluster.

Conclusion and impact

We found that embedded, school-wide AfL strategies helped teachers to become more confident in their own and each other's assessment judgements and so moderation activities became more reliable, efficient and rigorous. We now maintain a regular cycle of moderation, to check consistency in judgements. As we work on a 2-year topic cycle, teachers work across each phase to moderate judgements at the end of joint units taught. The process of jointly moderating work has brought teachers together to work supportively and is an excellent forum for the Science Subject Leader to identify CPD; to be consistent and certain of judgements, teachers need to be certain of their subject knowledge and the progression within it.

Moderation is now seen not as an outcome that necessitates portfolios of work – but as a process of engagement with subject knowledge and understanding of children's conceptual development. Moderation is agreement of assessment – to ensure parity of judgements and understanding of standards promoting better outcomes for children's learning. It can be achieved meaningfully when a school has a rich science culture and teachers engage in a range of ongoing formative assessments and professional discussions.

References and resources

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Pauline Rodger is Science Subject Leader and Year 6 teacher at Holt Primary School. She is also a Primary Science Teaching Trust (PSTT) Fellow and SLE for science.

See Pauline discuss active involvement of pupils here: **http://tinyurl.com/HoltTAPS**

Supporting staff to develop a shared understanding of science assessment

Carol Sampey outlines how science and assessment can be brought together effectively through highlighting developments at Shaw Primary

Assessment is not something that stands alone and teachers need support to develop their understanding of both assessment practices and the subject being assessed. We were fortunate to take part in the Teacher Assessment in Primary Science (TAPS) project and, in this article, I will explain how a shared understanding of both science and assessment was developed at Shaw Primary School.

At Shaw, we tried to ensure that science assessment was effective across the school by:

- **investing time to develop a shared understanding of what 'good science' looks like;**
- **making teachers aware of how to integrate teacher assessment into every lesson; and**
- **ensuring that progression in the 'working scientifically' skills took place.**

Our first step was to agree key aims and principles to be remembered when planning and delivering science lessons (see Figure 1), a Primary Science Quality Mark (PSQM) activity. All staff were involved in discussing what this meant for us and agreed that: *'Our main aim is to ensure that the children are engaged and enjoying science by the use of careful planning and a wide range of teaching and learning approaches'.*

Having agreed WHAT we wanted children to be able to do in science, we then discussed HOW to achieve these things in practice (see Figure 2). Once these key principles had been established, we agreed a curriculum map for science (vital if the school has mixed age ranges), to ensure that all of the National Curriculum for England (NC) requirements were covered. It was also important for staff to have time to discuss exactly WHAT the statements in the NC Programme of Study actually meant. Some of the statements are very broad and need unpicking, particularly with regard to assessment: this helped all staff to have a shared understanding of expectations. Purchasing a scheme of work may be useful to support and guide staff when planning, especially if you have inexperienced staff who lack confidence in teaching science. However, at Shaw, although the

Figure 1 Principles for science at Shaw

Figure 2 Implementation of the principles of science agreed by teachers at the school

scheme of work was used for initial ideas, teachers were encouraged to adapt these into activities that made best use of the school's locality, cross-curricular links and ideas that arose from children's own questions.

Planning with assessment in mind

Well-planned lessons are the key to ensure that teacher assessment is effective. At Shaw, staff used the NC statements to think about the learning outcome that they would expect to see if the children had achieved the expected level in both knowledge AND in working scientifically, and then planned learning objectives accordingly. The PLAN materials published by ASE give a really helpful framework for staff, as the conceptual learning objectives are broken down and guidance is given regarding evidence to look for in the learning. Working scientifically was woven into every lesson and teachers made use of *key questions,* which would help to assess the learning taking place. The TAPS assessment materials and their Focused Assessment lesson plans give a particularly helpful structure for lesson planning to support the development of working scientifically. Formative assessment was ongoing, based on key questioning and observation during the lessons as well as written evidence. Teaching Assistants had a valuable role in gathering the assessment evidence, but needed to be well briefed beforehand. At the end of each topic, the formative assessments were used to make a summative judgement for each child, and recorded.

Developing a progression in working scientifically

It was in understanding the progression in working scientifically across the school that staff needed most support and, initially, time was devoted to staff development (staff meetings/ teacher development days, etc.) Once established, the Subject Leader regularly reviewed the policy, giving annual reminders of expectations, and briefed all new members of staff so that they were aware of how the school taught and assessed science and, in particular, how skills progression was built up from Early Years Foundation Stage to Year 6 (age 11).

Supporting structures consisted of:

'Science Stars': our version of 'I can' statements – outlining what children should be able to do in each year group (see Figures 3 and 4). Staff chose a maximum of two or three skills per topic upon which to focus. The skill was taught and discussed with the children as to what they should be aiming for, what 'success' looked like and involving them in self-assessment.

Planning Proformas: to support children (and teachers!) when planning investigations, proformas were used with younger children but, as children moved through Key Stage 2 (ages 7-11), this support was gradually withdrawn so that, by Years 5/6 (ages 10-11), children were expected to plan independently.

Encouragement to record in a variety of ways: Science books were used, but a variety of ways to record were encouraged, ranging from floorbooks (especially at Key Stage 1 – ages 5-7), photographs, drama, pictures and diagrams, models and links with literacy and numeracy (e.g. graphs and tally charts, fact files, letter-writing, persuasive writing and news reports, use of ICT, etc). All provided valuable evidence of the learning taking place and many of these can be seen in the TAPS Focused Assessment database.

Development of Scientific Language: Word banks for each topic were displayed for the children and incorporated into spelling homework.

Sentence Structures: these were modelled to help children to predict, explain their ideas, analyse and draw conclusions.

Question stems were displayed to help children to ask their own questions and make decisions as to how to find out the answers.

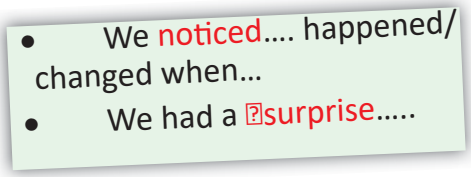

Figure 3 Science star example for Year 2 (age 6-7) – noticing patterns

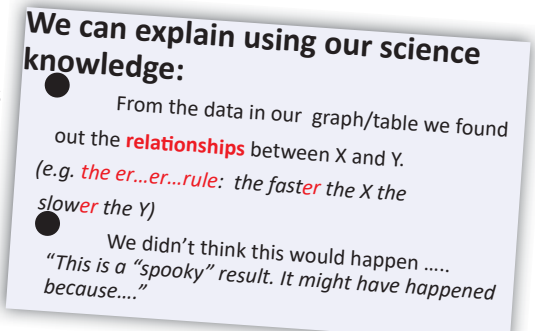

Figure 4 Science star example for Year 5/6 (age 9-11) – explaining findings

Moderation staff meetings

To ensure that the assessment judgements are valid and reliable, it is important that regular moderation takes place. Members of staff were asked to bring along evidence of learning to a staff meeting and agreement was reached both for knowledge and understanding and working scientifically. Initially, this took up a whole staff meeting but, as staff became more confident, this was reduced to a 10-minute slot three or four times a year.

Staff meetings were also used to focus on working scientifically across the school to see if progression was taking place. Work samples were collated as a useful reference bank for staff (and Ofsted). Annual monitoring by the Subject Leader also took place through book scrutiny/ lesson observation/curriculum walks, etc. and evidence from this was used to support staff further if necessary.

Conclusion

The work to develop a shared understanding of science and assessment across the school is a long-term and ongoing project. Our involvement in the TAPS project has supported a whole school emphasis on science assessment and we have found that, once staff feel confident in WHAT and HOW to teach science, teaching, learning and assessment are more successful. It is important to continue to build and support the shared understanding, with new staff joining the team and new priorities at a local and national level, but a focus on active learning, with both pupils and teachers engaged in quality talk, helps to provide a variety of assessment opportunities and maintain our principles with science at the heart of the curriculum.

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Carol Sampey is a Primary Science Teaching Trust (PSTT) College Fellow and Area Mentor and was formerly Deputy Head at Shaw School, Melksham.

See Carol describe science at Shaw Primary here: **http://tinyurl.com/ShawTAPS**

Assessment of working scientifically – the TAPS Focused Assessment approach

Let's focus on... making balloon rockets!

Kendra McMahon explains what Focused Assessments are and why they are effective for both teachers and learners

What is Focused Assessment?

The assessment of working scientifically (science enquiry) is a challenge. How do you assess what thirty children are thinking and doing in a lively practical session? In this article, we will unpick what the challenges are in more depth and explain how the TAPS Focused Assessment approach offers a manageable response to them.

The TAPS Focused Assessment approach embeds assessment within normal classroom science activities. In essence, a Focused Assessment is a lesson plan for a science enquiry, with an identified focus for assessment and guidance on how to interpret the children's responses in relation to expectations for that age group. We recommend that they are used about two-thirds of the way through a science topic, so there is still time for teaching to respond, and the assessment can also be used as a broad indicator that contributes to building a picture of the child's achievement in working scientifically.

This is a free, downloadable resource, developed by teachers and university researchers with funding from the Primary Science Teaching Trust (PSTT). The materials and further explanation can be found on the PSTT website: **https://pstt.org.uk/resources/curriculum-materials/assessment**

There are two kinds of resource: ones that focus on assessment of a particular concept, such as what damages teeth, or suitability of materials for their use, and those that we discuss here in this article – which support the assessment of an aspect of working scientifically, such as raising questions, or interpreting data, in a conceptual context.

Importantly, they assess children doing a real, hands-on enquiry, so they have more validity than a pencil and paper test. They help us to make judgements about the ways in which children behave in action. Although the teacher will focus his/her attention on a fairly narrow area, the children may well use a whole range of knowledge and skills during their investigation.

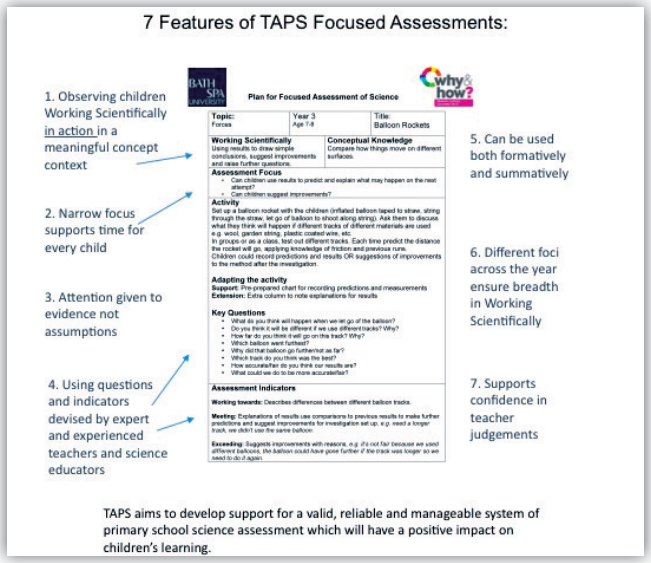
So many children, so little time!

Assessment always involves sampling – we can never know the whole of what is happening inside a child's head, all of the time. Once we have reconciled ourselves to the fact that assessment cannot be perfect, we need to identify our choices and make some decisions about how to make it 'good enough' for purpose. In the limited time we have, we can either assess a few children in depth over a broad range of science, or we can assess more children over a narrower range. The TAPS Focused Assessments have selected a focus for assessment that is narrow enough to make it possible to assess all the children in a class within a reasonable timeframe. The classroom organisation for this varies a great deal with the age of the children and the specific enquiry, but aims to make assessment of children in action manageable.

Working scientifically is complex!

Any full scientific enquiry involves a complex set of skills, knowledge and attitudes. It involves deciding on a productive question and how to go about answering it. There are decisions to be made about what

An example of a Focused Assessment



information will be recorded and how it will be interpreted. The English National Curriculum is designed to show how different skills and knowledge are brought together, as in this statement on 'Working Scientifically' for Lower Key Stage Two (age 7-9): *'using results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions'* (DfE, 2013). But to simplify this complexity we can group working scientifically into three broad strands: *'Plan, Do and Review'* and TAPS has designed activities that help teachers to assess within one strand at a time. A different strand can be the focus each term so that, over a school year, they build up to give an overall picture. Some project teachers also decided to focus their teaching that term on the same strand.

We recognise that working scientifically is complex, and realise that one assessment will not give a definitive view of all a child understands and can do, but suggest that Focused Assessment can offer particular insight, which can be combined with information gained from informal observations.

I know my children – do I need to do this?

A great strength of primary teaching is that teachers get to know the children in their class well, and see them as whole people with different strengths across the curriculum. However, in forming a holistic view of a child, we sometimes over-generalise, and miss a child's particular strengths or don't realise that there are areas that they haven't understood. Some children come to our attention more than others but, by making sure we have observed every child, we can be sure that we have some evidence against which to check our informal judgements and that no one has slipped past our attention.

Psychological research into unconscious biases (Kahneman, 2011) shows that we are all vulnerable to make judgements that we are not aware of, and this happens even if we are aware of the dangers of cultural stereotyping. One bias is the 'halo effect', where having formed a good view of a person, we are then more likely to see all their actions as good. Another is confirmation bias, when we notice or look for evidence that confirms our ideas and reinforces them. As teachers, we might assume that a child has understood something more than they have. In the TAPS project, experienced classroom teachers sometimes used the Focused Assessments to check where they were unsure about what a child or group of children could do and also to make sure that every child had a moment of the teacher's thoughtful attention.

We propose that this attention to *every child* helps to make our summative assessment more valid than relying only on informal judgements. We would strongly recommend an 'expansive' approach (Lum, 2015) in which teachers make judgements about the value of the different sources of evidence they have available to them and combine them accordingly.

A focus on what? Concepts, contexts and types of enquiry

The child's knowledge of the context and understanding of relevant concepts has an impact on how they make sense of the situation and what possibilities they consider. Some areas of science lend themselves more easily to a certain type of enquiry than others; for example, learning about natural habitats is not generally amenable to fair testing, but observation over time and pattern-seeking enquiries are useful approaches. Where variables can be identified and controlled, there is potential for a fair test type of enquiry – e.g. *What's the most waterproof material? How can we make the best parachute?* As we want children to encounter the full range of types of enquiry, this range of concept contexts is actually very helpful; however, it may need mapping out to check that children are encountering a good range in working scientifically. There is a full range of Focused Assessments available, currently based on the English National Curriculum, so that teachers can use them to assess the full range of types of enquiry, and these have been mapped out to show how they could build up over a child's time in primary school.

Ongoing research

So far, the TAPS project teachers and tutors have looked at how the Focused Assessments are being used in the project schools, and this inevitably means that the teachers have been thinking in depth about science assessment. We have made detailed classroom observations of Focused Assessments in action, so far mostly in the classes of experienced teachers, looking to see to what extent our claims about them are true in practice (see the articles by TAPS project teachers Kerry-Anne Barber and James Mepsted in this issue for their perspectives.) Our next step is to find out how the Focused Assessments are being used more widely and by less experienced teachers and how we can improve the resource for them. With over 30,000 downloads to date, we would like to find out what the wider audience thinks of them and how they are using them. We would welcome your feedback – please e-mail us on **primaryscience@bathspa.ac.uk**

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Kendra McMahon is a Senior Lecturer in Education at Bath Spa University.

See Kendra explain more about Focused Assessment here: **http:// tinyurl.comTAPSfocusedasst**

Digestion display

Using TAPS Focused Assessments as part of our teacher assessment approach

Kerry-Anne Barber looks at the Focused Assessments in action and her experience of them being translated into practice

As the Science Co-ordinator at St Paul's RC Primary School, I have been involved in producing and trialling resources for the TAPS project over the last four years. The following article explains how St Paul's has used the Focused Assessments (FAs). I have always tried to promote enquiry-based teaching, which addresses the needs and curiosity of the cohort whilst ensuring that all statutory content is covered, so felt that this should also be reflected in encouraging staff to employ a range of assessment methods. FAs are a resource to support, but not dictate, science assessment.

Use of Focused Assessment tasks at St Paul's

The FAs have been introduced to all staff and revisited through INSET training and staff meetings, where I felt that it was important to give teachers the time and opportunities to explore the assessments that were most relevant to their year groups. I emphasised that FAs are a good bank of resources, which address specific assessment strands, but that teachers should tweak them and shouldn't use them for the sake of it if they had a more relevant method of making a professional judgement. Throughout the four years, staff members have felt confident dipping into the bank of FAs and have used them to inform their judgements alongside many other methods of assessment.

Validity and reliability of Focused Assessment tasks

Each Focused Assessment task is set out with reference to the 'working scientifically' and 'conceptual knowledge' strands that they

address and really capture a clear picture of the children working in a practical task. The activities are detailed enough to follow clearly, but ideas for adapting the tasks are also provided. For each FA there are clear assessment indicators and key questions that are designed to determine whether there is evidence that pupils have 'not yet met', 'met' or are 'exceeding' the assessment focus. Personally, I believe that the most relevant of these three is the meeting indicator, as this is the level that children are expected to reach, whilst the exceeding strand may be too narrow and restrict teachers to specific extension activities, when often the pupils will suggest their own ways of extending a task that are more pertinent to what they want to explore.

The assessment indicators are ideal for use as part of whole school moderation. These are also reinforced by the exemplar materials showing evidence of work that has met the standard.

Currently, we are in what could be deemed a more fortunate position in primary science, where end of key stage assessment is rarely used for performance management or school targets but, with the right leadership, can be monitored to improve the overall quality of teaching and learning. At St Paul's, regular monitoring of each year group's assessment grids ensures that gaps can be analysed and, through discussion with the teacher, it can be determined what needs to change to address these gaps. This may involve further training, resources, identification of a suitable assessment method (such as an FA), or juggling the curriculum to ensure that there is enough time to address each assessment strand. This is where the roles of the Science Co-ordinator and the Senior Leadership Team are so important as, when teachers feel supported rather than judged, teachers are more honest in their judgements and there will be less possibility of bias affecting grades – their assessments will be more valid and reliable.

Manageability

Generally, staff have felt that Focused Assessments are easy to use and adapt, as there is a wide variety from which they can choose to address particular 'working scientifically' assessment strands. Manageability of the FAs all depends on picking the right activity and not just using an FA for the sake of it if you've already covered the strands in another way.

For those teachers who are less experienced in science, as well as trainee teachers, I feel that the FAs have been a great bank of resources to dip into and that they provide reassurance in their judgements. They are not onerous to plough through, as they have only the key points included and the database is easy to search. The inclusion of examples of work meeting the assessment criteria also provides clear guidelines to teachers as to what to look for.

At the other end of the spectrum, experienced science teachers are confidently using the key questions and activities as a general guide and adapting them according to the needs of their cohort. The activities are straightforward to adapt and, as long as you are clear about the assessment criteria you are addressing, the tasks, key questions and assessment indicators can easily be changed to respond to the needs of a particular cohort of children. For example, I taught a child who had very poor literacy skills, struggled to write a sentence and who was hard to generally engage in learning. However, he soon displayed a real aptitude and love of science, so it was very important that my assessments of him were based upon his scientific ability rather than his literacy skills. I adapted the Focused Assessments to ensure that there were enough opportunities for him to express himself through multimedia approaches and, at the end of the year, we were both very proud that he had met all the end of Year 6 (age 11) interim assessment criteria in science.

Conclusion

Whilst the staff at St Paul's have found the Focused Assessments a good bank of assessment resources to use and support their judgements where needed, it is important to also instil in staff a sense of professional responsibility for their own judgements and reassurance that they do not need to provide evidence for everything. The teacher is best placed to assess the pupils in their class and many judgements can be provided through discussion and assessment opportunities that often arise at the most unexpected moments! The inclusion of key questions and assessment indicators are generally a very clear, supportive assessment tool, but teachers shouldn't restrict themselves to just looking for modelled answers to the detriment of other assessment opportunities. Due to the very nature of a good science lesson, children will choose their own methods of exploration and investigation and it is important that teachers are well organised and flexible to go with the children's ideas, even if this does go 'off plan', as these will provide better learning opportunities for them. When conducting such a child-centred investigation, children may provide good evidence of meeting several 'working scientifically' objectives, not just those that are of a particular focus for that lesson.

At St Paul's, the use of Focused Assessment tasks has certainly enriched our science assessments as part of a wider, more holistic bank of assessment strategies and resources. Ultimately, all teachers need to be clear about what it is they are trying to assess and what is the most appropriate and exciting method for the individual needs and curiosities of their cohort. As soon as assessment becomes prescriptive, however brilliant the resource, then that is when it will fail to address the needs of all pupils.

Kerry-Anne Barber was Science Co-ordinator at St Paul's Catholic Primary School in Yate.

Supporting the teaching and assessment of working scientifically

James Mepsted considers a range of strategies that help to support the teaching of working scientifically within schools and lead to effective assessment

Children investigating reaction times

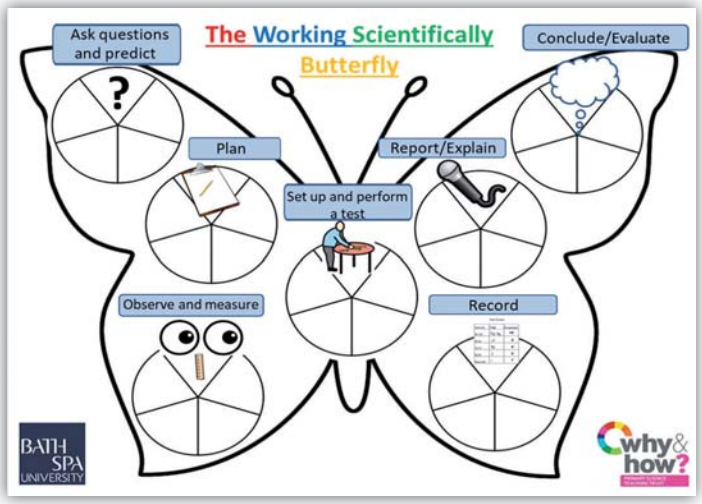
My project aimed to develop and implement the assessment of working scientifically (WS) skills at Victoria Park Primary School. I had previously identified a gap in the curriculum coverage and assessment of WS skills and my goal was to address the lack of provision for assessing children's WS skills and raise the confidence of teachers in assessing these skills.

Science teaching in my school takes an enquiry-cycle approach, with termly blocks that focus on history, geography and science topics and draw upon other areas of the foundation subjects. Before I was able to develop assessment of WS, I needed to raise its profile. I used the school butterfly emblem to create a way of sharing and tracking coverage of WS (see Figure 1). The WS Butterfly is stuck on the classroom wall, making it a visual tool for both adults and pupils. A segment can be coloured in at the end of the lesson, so that pupils can see the specific skills they are using and adults can see what they still need to cover, so helping with planning. As a subject leader, it has been a quick way for me to gather coverage evidence of WS at any point in the year.

I believe that, in order to effectively assess a WS skill, a single skill should be focused on in a single science lesson. This gives the teacher the scope to teach, in depth, the necessary components that make up that skill, and offers the pupil the opportunity to effectively learn the skill. Subsequently, it allows the teacher to assess the skill against a set of assessment criteria and reflect on his/her teaching.

Having raised the profile of science in the school I felt it necessary to develop further support for teaching and assessing the WS skills. As part of TAPS 'Responsive Teaching', ongoing formative assessment should include: 'Teachers gather[ing] evidence of their pupils' learning through study of the products of activities and tasks' and I felt that the TAPS Focused Assessments could help to do this. I wanted to provide further structure to support pupil and teacher recording of the focused skill,

Figure 1 The Working Scientifically Butterfly



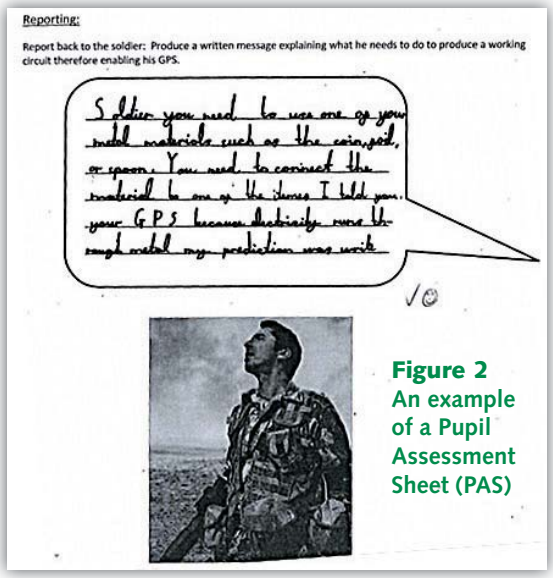


Figure 2 An example of a Pupil Assessment Sheet (PAS)

but also to encourage teachers to use their creativity, so I created template documents that they could adapt. The Pupil Assessment Sheet (PAS, see Figure 2), as well as working on a formative basis to record day-to-day assessment and to drive planning for future WS skill-focused lessons, would ultimately help to inform teachers on a more summative basis when reporting Interim Assessment Framework (IFA) levels at Key Stage end or an achievement level for WS skills in pupils' end of year reports. The development and introduction of a document for teachers to complete following a WS-focused lesson resulted in a Teacher Assessment Sheet (TAS, see Figure 3), which meant that the valuable learning demonstrated by pupils on the PAS was used to provide teachers with the necessary information to adapt teaching and learning approaches and, therefore, drive the continual improvement of pupils' learning.

The PAS and TAS were developed and trialled as part of my NPQML (middle leadership course). I began by modelling some initial ideas of my project with the school assessment co-ordinator and trialling the PAS in one class. The 'audience' for the trial PAS was a 'soldier', as the task was to produce a working electrical circuit for fixing a soldier's GPS. The children worked together to fix the soldier's GPS, but completed individual PAS at the end of the lesson, allowing the class teacher and myself to accurately assess the learning outcomes.

I met with representatives from other year groups to trial further. In an early meeting, the team reflected on the success of the trial PAS document and discussed ways in which we could address this issue of manageable recording, ultimately developing a redrafted version of the PAS that included an optional word bank. The early implementation of these documents in my own class was particularly valuable in the run-up to a staff meeting that I would be leading for all teachers, to promote the use of the PAS and TAS documents in a whole-school science enrichment day. I would also be communicating my vision for the outcome of the day, which was to implement their use across the school during science-based enquiry lessons.

The science enrichment day was a fantastic opportunity for children to be actively engaged in collaborative learning on science tasks that had 'global perspectives'. Teachers were also able to collaborate during the science day staff meeting, picking from a range of activities for their planning team. They had time to try the activities themselves, select a suitable activity for their year groups and begin to create a Focused Assessment for their science day lessons. The focus of the day was for every pupil to complete a PAS and for every teacher to subsequently complete a TAS assessing the 'reporting and concluding' WS skills. The teachers were actively engaged in the planning process, working with their colleagues to adapt the templates. The whole school science day provided the time for teachers to explore the Focused Assessments, just as they had done with the WS Butterfly the year before. It also meant that I could ask for samples from each class to carry out a school-wide moderation, to consider whether the use of Focused Assessments and the templates had supported the teaching and assessment of working scientifically.

For a middle leader, the staff voice is vital to help to steer and drive a project forward, so I created a questionnaire relating to the assessment of science in the school. At the beginning of the year, the question regarding staff confidence in accurate assessment of WS skills, was scored, on average, at 5.6 (with a range of 3 to 8) on a scale of 1 (most confident) to 10 (least confident). At the end of the year, when asked how confident they were in accurately assessing the WS skills of the pupils in their class, the average score was 2.83 (a range of 2 to 4). One teacher noted on their end of year questionnaire: *'I think the PAS that I have done with my class have been extremely informative'*. Another said: *'[TAS and PAS have] been a fantastic way to focus the planning of the science curriculum onto more of the working scientifically skills'*.

The next stage in my role as Science Subject Leader is to monitor the use of the PAS on a regular basis and provide support to teachers along the way. I will continue to research and develop more efficient methods of recording and tracking the assessment of the working scientifically skills. In the long run, I hope to develop an online science assessment strand of the school tracking system currently used for core subjects. This would allow deeper analysis of trends within the data and provide a non-paper-based approach to collating.

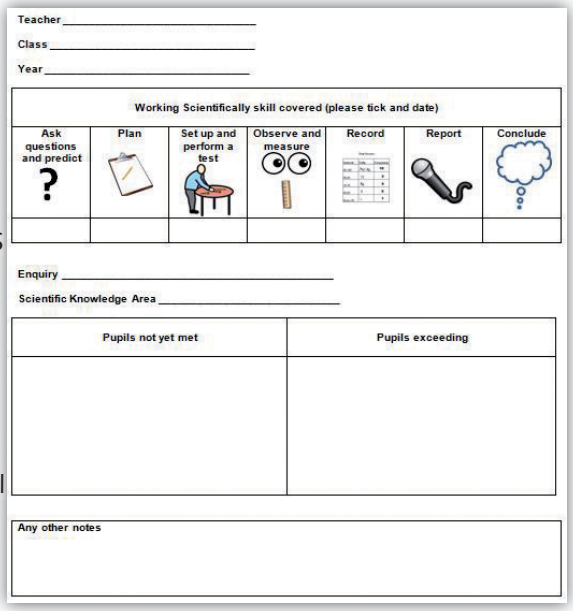


Figure 3 An example of a Teacher Assessment Sheet (TAS)

James Mepsted is Science Subject Leader and Year 5 (age 10) teacher at Victoria Park Primary in Bristol.

See James describe the Working Scientifically Butterfly here: **http://tinyurl.com/VPTAPS**

Supporting transition

Asima Qureshi and James Petrucco offer ideas around supporting the transitions between year groups and stages of schooling

Children taking part in a transition event

Meadowbrook Primary School has explored the use of TAPS Focused Assessment to support transition, initially for transfer to secondary school and now for transition from Early Years Foundation Stage (EYFS) into Key Stage 1 (ages 5-7). This article will consider an example of a secondary transition project and discuss the potential of the use of TAPS resources to support transition in other year groups.

Using TAPS Focused Assessments

Teachers were asked to complete a TAPS Focused Assessment with their classes and then collect examples of pupils' work to bring to a staff meeting aimed at supporting moderation discussions. The advantage of using Focused Assessments is that a specific skill can be focused upon, which allows teachers to see who has 'got it' by the end of the lesson, together with helping to define the next step for teaching, thus providing information for both summative and formative assessment.

Teachers have commented that:

'Focused Assessments give a clear indication to support future planning'

'Using Focused Assessments helps us to integrate assessment within a topic'.

Using Focused Assessments to support transfer to secondary

In July 2016, Focused Assessments were used as part of a transition project for Year 6 (age 11) to Year 7 (age 12) at Meadowbrook Primary School in Bradley Stoke, South Gloucestershire (part of the Olympus Academy Trust – OAT). The transition project built on previous transition projects: for example, by Martin Braund at the University of York (Braund, 2008).

The aims of this project were to:

- Improve progression and continuity from Year 6 to Year 7;
- Develop formative assessment and the teaching of 'working scientifically';
- Allow collaboration between secondary and primary teachers to create better cross-phase partnerships with primary schools (Ofsted, 2015); and
- Improve cross-curricular links.

Since many of the chemistry topics within the English National Curriculum are often completed in Year 5 (age 10), this project focused on consolidating and developing Year 6 children's working scientifically skills within a *chemistry* context. Children undertook six chemistry investigations, which were jointly planned with the secondary teacher and set out as Focused Assessments (see Table 1). Five of these were taught by a primary school teacher and one by a secondary teacher at the local secondary school. The assessments also included a context for the investigation and experiments introduced pupils to both Key Stage 3 (age 11-14) Chemistry Knowledge and Working Scientifically objectives.

Each Focused Assessment also had a literacy focus (e.g. Box 1) supported by the project being based around the book *Itch* by Simon Mayo, which describes a boy who has made it his mission to collect elements of the periodic table. This provided a context and a literary audience for the Focused Assessment lessons; for example, in Box 1, the letter sets up an investigation regarding the factors that affect how quickly salt dissolves in water.

Box 1 To write an explanation and use causal connectives

Dear Students,
Itch has done some research on salt and found out that it is made of the elements Sodium and Chlorine. He wants to investigate which factors affect how quickly salt dissolves into water. The factors he will look at are water temperature and stirring. Can you help him?
Jack

Outcomes of the project:

- Collaborative planning and reciprocal visits ensured that there was consistency in teaching between different schools and a shared understanding of progression – a key part of the TAPS pyramid.
- Allowed teachers to assess working scientifically skills and conceptual knowledge together in one lesson.
- The TAPS Focused Assessment planning structure provided teachers

Table 1
Our chemistry Focused Assessment lessons

Activity	Science focus	Literacy link
Making bath bombs – a chemical reaction that produces a gas	To observe what happens when an acid and alkali interact	To write an explanation
Dissolving salt – investigate which factors affect how quickly salt dissolves in water	To record data and results using tables To make predictions using scientific knowledge and understanding	To write a set of instructions for Itch's cousin Jack on how to do this investigation
Raising hands – combine baking soda and vinegar (with rubber glove on top)	To use appropriate scientific language and ideas to explain, evaluate and communicate their methods and findings	To write an explanation To use scientific vocabulary
Hardness of rocks	To interpret information in a table	To identify if evidence supports the statement
Periodic table (led by secondary teacher)	To investigate the varying physical and chemical properties of different elements using flame tests	Finding things out using a wide range of secondary sources of information.
Burning candles – How will changing the size of a beaker affect the time it takes for the candle to go out?	Planning a scientific enquiry to answer a question, recognising and controlling variables.	To write an explanation

with a list of questions to ask pupils and assessment indicators.

- Key Stage 2 (ages 7-11) and Key Stage 3 teachers moderated examples of children's work, which encouraged collaboration – another key part of the TAPS pyramid monitoring layer.

Potential for smoothing the transition from EYFS to Year 1 (age 5-6)

As a teacher in Reception currently and previously in Year 1, I can say that moving from the EYFS Development Matters curriculum (2012) in Reception (age 4-5) to the Science National Curriculum in Year 1 can be a giant leap for some children and to ensure this happens successfully is a constant conversation in primary schools. There are many different ideas as to how this should be achieved and I have outlined below the thoughts, ideas and reasoning for some of the decisions.

To implement the Development Matters curriculum successfully in Reception, children learn best when they 'do', when they discover and explore. Children need the chance to go out and experience the world in order for them to understand it and, in Reception, the role of the teacher is to expose children to prompts to promote discussion in order to help them formulate their ideas of what they see around them.

When moving on to the National Curriculum, the role of the Year 1 teacher is also to provide experiences in a fun, practical, play-based way, mirroring the Reception classroom environment, but also to provide more formal opportunities to record ideas, record results and draw conclusions. This can be achieved by working with small groups of children to develop their working scientifically skills, building on the practical play that they have experienced. This will help the children to think more formally about the science they do.

For example, when conducting an ice balloon activity with a Reception class, the teacher has to carefully plan and think about how to organise the class and activity for the children to access. Early on in the Reception year, it might be more appropriate to have the activity accessible to children through continuous provision, for children to explore the ice balloons if they choose. Alternatively, if the teacher would like to actively assess specific children, organising them into groups to do this adult-led activity may be more appropriate. To aid transition into Year 1, where whole class teaching will increasingly be the expectation, the ice balloons could be explored as a whole class, passing the ice balloon around the circle with children taking turns to describe it, as we have written in the TAPS focused task. This would ensure that all children will be exposed to the scientific concepts taught, but the teacher would struggle to assess every child in this way.

There is some debate as to when more formal science should begin and this could be determined by the children being taught. Some teachers think that, by the end of Reception, children should be experiencing more formal education and lessons to prepare them for Year 1 and this can work if there are children mature enough to apply themselves to it. This exposing to science can help to set the expectation of what science is like the following year and give the children a firm foundation to start with. However, other teachers expect that this period of transition happens at the beginning of Year 1, as many children will still be getting used to working in a more formal Year 1 environment, so a period of time at the beginning of the year to settle them in is more useful to help children to understand the new expectations put upon them. It is worth noting that good Reception and Year 1 teachers will have had transition conversations to determine where their children are, to best determine how the beginning of Year 1 should look; therefore, this could potentially differ from year to year, or indeed from child to child from the same cohort of children.

Next steps

At Meadowbrook Primary School, we use the TAPS Focused Assessments to support both our in-class assessments and discussion between phases and schools. We are creating our own Focused Assessments, which include engineering and other cross-curricular links. We would like to continue to develop dialogue between phases by planning and creating opportunities for discussing pupil outcomes together.

References

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Ofsted (2015) *Key Stage 3: the wasted years?* Manchester: Ofsted.

Asima Qureshi and **James Petrucco** are Science Subject Leaders and class teachers at Meadowbrook Primary School, Bradley Stoke, South Gloucestershire.

See Asima explain more about the *Itch* project at: **http://tinyurl.com/TAPSmeadowbrook**

TAPS for pupils

Sarah Earle pulls together this special issue and shows that TAPS is not just for teachers, but also for the learners, through the voices of Science Subject Leaders…

By placing the Focused Assessment approach within the TAPS pyramid framework, schools are beginning to find a number of ways in which learning in science can be enhanced for pupils. The quotations in this article provide examples of the ways in which science subject leaders (SSL) describe the impact of TAPS on their pupils.

Enthusiasm for practical and multi-modal science

Some schools have found that, by using Focused Assessments, they have made their science lessons more practical, leading the children to be *'more enthusiastic about their learning in science, and they're more excited about doing it'* (SSL-G, June 2017). TAPS provides examples of different ways to present science ideas: *'It's allowed them to express it in different ways… if we ask them to explain, to show, to demonstrate, to act out, to video-record, any of the more visual, more audio, they are much better at it'* (SSL-D, June 2016).

Supports disadvantaged learners

By broadening the range of assessment evidence, *'reluctant writers'* benefit (SSL-T, June 2017) and, by providing opportunities for open science investigations, *'children with very limited academic skills just come to life when they do things like this, they've got all the ideas in their heads and this gives them an opportunity to shine'* (SSL-E, June 2017). A particular example of this was described by one SSL: *'Science was a real hook for W who was disapplied for KS2 SATs and generally quite disengaged with learning, both in the classroom and at home. Highlight came when delivering his adaptation presentation about the Venus Fly Trap. At the end of the year, W had met all the interim science assessment criteria and was working at the expected level – a fantastic achievement, which gave him confidence and self-esteem'* (SSL-P, November 2017).

Giving pupils a voice

Some teachers describe a greater focus on dialogue and discussion in science: for example, *'when I've slowed it down and taken the time to unpick some of the things that they've said, it's been the most high-quality science I think I've probably ever done'* (SSL-T, June 2017). Others describe the way that pupil voice had been amplified, giving the pupils *'ownership of the lessons'* (SSL-P, June 2017); *'It's not happening to them; it's happening with them and by them'* (SSL-H, June 2016).

Ongoing and active pupil involvement

Providing opportunities for self- and peer-assessment; for example, with children deciding on their own success criteria, has meant that *'the children have got a better understanding of what they need to do, and why they need to do it'* (SSL-G, June 2017). *'Formative assessment is a more ongoing teacher- and pupil-led process. Pupils are actively involved'* (SSL-H, October 2016).

Active involvement of pupils in their science learning is a key principle of the TAPS pyramid and its application is an ongoing area for research in the next phase of the project. We have found that the Focused Assessment approach has provided a 'way in' for many schools and further examples of how to place this within the broader TAPS pyramid framework are currently being developed.

Sarah Earle is TAPS project lead and Senior Lecturer at Bath Spa University.

Other members of the BSU TAPS team include Kendra McMahon, Alan Howe and Chris Collier.

News from the Primary Science Teaching Trust (PSTT)

Why and How?

The Primary Science Teaching Trust's termly newsletter

We are delighted to be able to share our newsletter. This is a termly digital production, available on our website at https://pstt.org.uk/what-we-do/why-how-newsletter

Our newsletter is very much aimed at all teachers and anyone with an interest in primary science.

Each issue has free pullout resources, ready for instant classroom use. These include a picture for talk in science, a whole school challenge and a piece on misconceptions and how to address them.

Please do also actively encourage others to pass our newsletter on to their networks and, if anyone would like to be added to the mailing list for it, please contact Amy Thorman on amy.thorman@pstt.org.uk

why & how?
PRIMARY SCIENCE TEACHING TRUST

The Primary Science Teaching Trust's International Science Education Conference (PSEC)
6th – 8th June 2019 in Edinburgh, Scotland

Over three days, in the beautiful city of Edinburgh, PSTT will be offering a varied and carefully chosen programme of what we know to be the very best in professional development for primary science education, delivered by experts. The programme includes: keynote speeches * practical workshops * reflective seminars * science shows * talks * social events * a primary-focused exhibition

We know that teachers value CPD sessions delivered by other practising teachers and we are delighted that our Primary Science College of award-winning teachers will be delivering workshops at PSEC. High quality contributions to the programme will also be made by our academic collaborators and strategic partners, and other world class experts in the field.

The Conference will cover the following themes:
Neuroscience and how we learn, play and early years, assessment, working scientifically, subject leadership, transition, evidence-informed practice, creativity, outdoor learning, STEM, SEND and EAL, gender bias, emotional and mental wellbeing, and information technology.

Our call for programme proposals opens in April 2018 and will close in September 2018.

Register your interest today by visiting the Conference website: https://www.primaryscienceconference.org/ and, to be included in our conference mailing list, please contact Amy Thorman on amy.thorman@pstt.org.uk

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