

Institution: Bath Spa University		
Unit of Assessment: 23 - Education		
Title of case study: Embedding best practice of Teacher Assessment in Primary Science		
Period when the underpinning research was undertaken: 2013 - 2020		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
Dr Sarah Earle	Reader: Primary PGCHE	1/9/2009 - present
Dr Kendra McMahon	Reader of Education	1/9/2000 - present
Prof Dan Davies	Head of Applied Research and Consultancy	5/10/1998 - 31/12/2014
Alan Howe	Head of Education and Childhood Studies	1/9/1992 - 31/7/2019
Chris Collier	Senior Lecturer: Primary Science	1/1/2005 - present
Period when the claimed impact occurred: 2014 - 2020		
Is this case study continued from a case study submitted in 2014? N		
1. Summary of the impact		
<p>The Teacher Assessment in Primary Science (TAPS) project was developed in response to a lack of national guidelines on assessment in primary schools. Working with 85 project schools across the UK, TAPS has become the best practice model for teacher assessment among leading science organisations, using iterative cycles of practitioner-researcher collaborations to develop innovative guidance for teachers to support children's science learning. TAPS has supported teachers, in and beyond project schools, to improve their primary science teaching practices and develop validity and reliability in school assessment processes. Face-to-face training has been delivered to over 8000 teachers across the UK. Freely available online, the TAPS resources have been downloaded by 223,700 unique users across 123 countries.</p>		
2. Underpinning research		
<p>The Teacher Assessment in Primary Science (TAPS) project (2013 onwards, with repeat funding from the Primary Science Teaching Trust) was initially developed in response to a lack of guidance following the removal of the statutory levelling system in England, which resulted in uncertainty regarding how to assess primary science, both formatively and summatively (R3). Since assessment processes are a key driver for classroom practice, this uncertainty also impacted upon the teaching of primary science, with reduced use of assessment to support learning; this was compounded by the low status of science in primary schools, due to school accountability measures being based on English and mathematics. Drawing on previous research on formative science assessment (IST project, R1, R2), the Bath Spa research team worked with schools in South West England to develop a new approach.</p> <p>The TAPS approach aims to enhance assessment validity and reliability, by developing shared understandings of criteria and progression. More recently, TAPS has expanded to address similar issues for teaching and assessment of primary science across the UK, developing principles and guidance for teaching the wide-ranging curricular of Wales (2016-18), Northern Ireland (2017-19) and Scotland (2019-21).</p> <p>TAPS utilises a qualitative Design-Based Research approach, whereby university tutors and school teachers work together as co-researchers to develop both theoretical principles and classroom resources to support the teaching, learning and assessment of primary science (R4). Research takes the form of iterative cycles of school visits and development days, working collaboratively with around 10 primary schools at a time to reflect on and refine resources. A particular strength of the TAPS approach is the principle of co-construction that facilitates rapid applications in the classroom (R6). Since project teachers trial approaches within their schools,</p>		

research and impact are interwoven from the outset, with impact beyond project schools following once resources are disseminated (R5).

The project makes 2 key original contributions to research and practice: the TAPS Pyramid (first iteration in 2014, development described in R4) and the Focused Assessment database (from 2015, developed from R1). The Pyramid is a theoretical model that exemplifies strong formative assessment practices and shows how rich information gathered in the classroom can be utilised for summative purposes. TAPS works with teachers to systematically design, refine and exemplify the pyramid-shaped model, which emphasises the active participation of pupils and the responsiveness of teachers as they utilise assessment for learning (R4). The Pyramid is hyperlinked to examples (first iteration 2015) from a range of project schools across the UK to support teachers in understanding and applying the principles to their context. The Pyramid has also been made into an accessible school self-evaluation tool, which science subject leaders can use to audit, action plan and develop assessment processes. This supports the translation of assessment principles into practice, for example, with teachers selecting formative assessment strategies to trial in school.

The Pyramid model is complemented by a growing database of Focused Assessment lesson plans and examples, from early years to those transitioning from primary to secondary school. The TAPS Focused Assessment approach (developed from R1) asks teachers to select 1 element of science inquiry at a time as the focus for attention and recording, making teaching and assessing science more manageable. This addresses the problem of uncertainty about how to teach and assess, providing principled guidance, which is specific to the classroom, supporting primary school teachers, who often lack confidence in teaching science.

3. References to the research

R1. McMahon, K and Davies, D (2003) ['Assessment for inquiry: supporting teaching and learning in primary science.'](#) *Science Education International*, 14 (4). pp. 29-39

R2. Davies, D and McMahon, K (2004) ['A smooth trajectory: developing continuity and progression between primary and secondary science education through a jointly planned projectiles project.'](#) *International Journal of Science Education*, 26 (8). pp. 1009-1021

R3. Earle, S (2014) ['Formative and summative assessment of science in English primary schools: evidence from the Primary Science Quality Mark.'](#) *Research in Science & Technological Education*, 32 (2). pp. 216-228

R4. Davies, D. J, Earle, S, McMahon, K, Howe, A and Collier, C (2017) ['Development and exemplification of a model for Teacher Assessment in Primary Science.'](#) *International Journal of Science Education*, 39 (14). pp. 1869-1890

R5. Hopwood-Stephens, I and McMahon, K (2019) ['Reaching in-service primary teachers with research innovations: the role of dissemination events in stimulating download activity.'](#) *European Journal of Teacher Education*, 42 (3). pp. 297-314

R6. Earle, S (2020) ['Balancing the demands of validity and reliability in practice: case study of a changing system of primary science summative assessment.'](#) *London Review of Education*, 18 (2). pp. 221-235

Research funding:

- Davies (PI), and McMahon (Co-I) *Teacher Assessment in Primary Science 1* (2013-2016), Primary Science Teaching Trust, GBP135,000
- Earle (PI), and McMahon (Co-I) *Teacher Assessment in Primary Science 2* (2016-2019), Primary Science Teaching Trust, GBP165,000
- McMahon (PI) PhD Studentship (2016-19) Primary Science Teaching Trust GBP57,500
- Earle (PI) and McMahon (Co-I), *Focus for Teacher Assessment in Primary Science* (2018-2021), Education Endowment Foundation and Wellcome Trust, GBP398,500 (plus GBP102,300 Covid-19 extension)

- Earle (PI), *Teacher Assessment in Primary Science 3* (2019-2023), Primary Science Teaching Trust, GBP150,000

4. Details of the impact

The TAPS project, based on the underpinning research, addressed a need for teacher guidance, after the removal of the levelling system, for assessment in primary science, also influencing classroom teaching and the status of science in schools. TAPS has impacted project schools, non-project schools and the primary science community due to the innovative way its Design-Based Research approach engages with practitioners in its ongoing development and dissemination.

Impact on practice in project schools nationally

Sustained collaboration with 85 TAPS project schools across the UK (2013-2020) has led to meaningful impact on teaching and assessment practices within those schools, with teachers reporting a clearer and more explicit use of assessment to support learning (E1-4). For example, schools used the TAPS pyramid to audit assessment processes and select an area to develop, with evaluation data showing increased teacher confidence, multi-modal recording and priority given to science (E5).

The project schools' evidence of development of assessment practices are included as examples in the Pyramid publications and website (eg 94 examples from 24 English schools, E1), 70 examples from 12 Welsh schools (E2). Teachers have described developments in formative assessment, including a greater focus on dialogue and discussion in science, which amplified pupil voice, 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” (Teacher T, E3).

“The pupils had more of an ownership of the lessons” (Teacher P, E3)

“It’s not happening to them; it’s happening with them and by them” (Teacher H, E3)

“The children have got a better understanding of what they need to do, and why they need to do it” (Teacher G, E3)

“Formative assessment is a more ongoing teacher- and pupil-led process. Pupils are actively involved” (Teacher H, E3)

By using Focused Assessment plans, and developing their own, the teachers made more use of practical activities, providing opportunities for open science investigations, leading the children to be: “more enthusiastic about their learning in science” (E3, Teacher G). Project teachers explain the impact on their classroom practice and school processes in YouTube videos (E4) and in the open access special issue of the Primary Science professional journal (E3). For example, as a result of the TAPS project, schools developed pupil self and peer assessment (E4, video 11) and whole school understanding of scientific inquiry skills (E3).

The 12 Transition project schools developed activities to support primary to secondary transfer, resulting in changes in vocabulary and levels of independence in lessons (E1). In Northern Ireland, the 8 TAPS-NI project schools reported a new focus on science skills, raising their profile in the country’s ‘World Around Us’ curriculum (E6).

National impact on practice beyond project schools

TAPS resources have been widely disseminated, with over 10,000 copies of booklets, 14,000 views of YouTube videos and 223,700 unique user downloads from a total of 123 countries (majority of downloads in the UK, E7). Teacher conferences and events across the UK have provided face-to-face training for over 8000 teachers since 2014 (E8), with additional training provided by the network of Primary Science Teaching Trust Fellows and science consultants

who recommend the approach (E9). Due to Covid-19, training has moved online, with over 500 teachers participating in events (E8).

The national and international dissemination of TAPS resources has led to widespread impact on practice beyond project schools, with teachers subsequently describing their changing practices (E10). Feedback from a sample of 200 schools via events (E10) and from 100 schools via online surveys (E11) provide details of how teachers have used the TAPS resources to change their practice. In these data, science subject leaders were found to use the Pyramid for school self-evaluation, then focusing on areas in subsequent action planning such as broadening the use of strategies or recording techniques (E11). Class teachers were found to use the Focused Assessment plans and examples to support their teaching and assessment of science inquiry. The TAPS resources supported teachers to develop a repertoire of formative assessment strategies, enhancing teacher confidence and improving assessments of progress (E10).

The Focused Assessment database provides support for science teaching, responding to national concern for the profile of science in primary schools. Teachers attending training, particularly from schools where primary science does not have a high priority, report an increase in the teaching of practical science as well as development of assessment practices (E6). TAPS training has moved from one-off dissemination events, to ongoing professional development, with teachers utilising TAPS resources in between meetings and returning to discuss their changes in practice. For example, in feedback given in 2020, teachers described the impact of using the TAPS resources:

“Really clear and engaging. Changed the way I plan and teach science.” (Teacher 2, E10)

“They've given me the confidence to give my children more freedom and focusing on one element to record has put the focus back on the practical science.” (Teacher 31, E10)

“Increased the amount of working scientifically. Children are more engaged.” (Teacher 25, E10)

“This makes the practical teaching of science achievable in the time.” (Teacher 35, E10)

“The activities are fun, focused and easy to implement. They have really made me think carefully about misconceptions and next steps.” (Teacher 10, E10)

“Children really enjoy this approach. Discussion at each stage makes assessment (ongoing) much easier.” (Teacher 19, E10)

TAPS is increasingly used to support teachers at the beginning of their careers, with the resources being utilised in at least 20 Initial Teacher Education (ITE) institutions across the UK (E8). Trainees use TAPS to support their understanding of assessment and to provide guidance on lesson planning in science. At Stranmillis University in Belfast, trainees and teachers used a co-teaching model to trial and develop TAPS resources (E6).

Impact in the primary science education community

Over the last 7 years, TAPS has grown into the ‘industry standard’ approach for assessment in primary science among the learned societies and subject associations. TAPS has been recommended by international experts, international professional associations such as the Association for Science Education (ASE) and in leading teacher textbooks and articles (E9). The ASE devoted a special issue of their professional journal to TAPS, with the editor providing this introduction:

The wealth of knowledge that underpins TAPS is, without exaggeration, phenomenal. The resources, which are constantly developing and growing, are accessible, usable and ultimately very useful. This special issue demonstrates quite clearly the difference that TAPS has made to the professional lives of a large number of teachers. (E9)

TAPS Cymru dual language resources are housed on the Welsh Government Hwb repository (E2), and Scottish resources are being developed in collaboration with SSERC, the national body for training in science. The project lead has been invited to deliver 10 keynotes across England and contribute to an increasing range of publications (E8). The TAPS approach is now being trialled in schools in China, Spain, Singapore and the Netherlands.

The Primary Science Quality Mark (PSQM) identifies TAPS in its criterion for assessment best practice for its 600 participants per year (E9), with evidence that PSQM schools use TAPS to broaden their range of assessment strategies (E12). TAPS has been integrated into a range of National Science Learning Centre assessment courses (E9). A TAPS training programme is currently the subject of a large randomised control trial in 7 regions of England, with 150 teachers from 75 schools attending training. When paused due to Covid, it is testament to the high regard for TAPS that both further funding was provided to repeat the trial and the majority of trial schools opted to re-join the project.

5. Sources to corroborate the impact

E1. Collection of examples of TAPS use in England: Pyramid pdf (2015) which includes **94 examples from 24 schools**, Pyramid booklet (2017) and Transition booklet (2019)

E2. Collection of examples of TAPS use in Wales, on Welsh Government website, in English and Welsh (2017) which includes **70 examples from 12 schools**

E3. Primary science professional journal TAPS special issue (2018) including **articles by 6 teachers**

E4. TAPS youtube playlist, featuring **10 English and Welsh teacher interviews and presentations** on use of TAPS (2016-current)

E5. Davies, D (2016) Evaluation Report 2015-16, including outcomes from **6 teacher interviews**

E6. Collection of TAPS examples from Northern Ireland: teacher booklet TAPS-NI booklet (2019) and article: Earle, S. and McCullagh, J. (2020) Developing understanding of science skills in Northern Ireland through co-teaching between pre and in-service teachers, Journal of Emergent Science, 18, 49-55. Including analysis of interviews with **6 pre-service and 6 in-service teachers**.

E7. TAPS website download data summary, containing details for the **223,700 unique user downloads across 123 countries**.

E8. TAPS dissemination and training events (2014-20) spreadsheet, with details of 'face-to-face' training has been delivered to **over 8000 teachers across the UK**.

E9. Endorsements for TAPS from:

- **experts in the field:** leading science assessment Professors from Bristol University and King's College London, Editor of Primary Science professional journal, Cambridge Primary Review Trust.

- **leading science organisations:** Association for Science Education, Primary Science Quality Mark, the Wellcome Trust and BBC.

- **recommended as part of training programmes:** National Science Learning Centre assessment courses, local provision and Thinking Doing Talking Science national project.

E10. TAPS paper feedback form responses: **200 teachers from 9 events across UK** (2016) and **142 teachers from 9 areas of England** attending a second TAPS training day (2020)

E11. Hopwood-Stephens, I. (2019) *How is a resource for changing teachers' assessment practice in primary science successfully disseminated, shared and enacted within a primary school?* PhD thesis, Bath Spa University. Including analysis of **100 schools** via online surveys and case studies.

E12. Examples of the use of TAPS from **13 Primary Science Quality Mark schools** from Round 13 (June 2017), including teacher reflections on their development of school assessment and evidence of this development from their Quality Mark portfolio.