HTSA
HACKNEY TEACHING SCHOOLS' ALLIANCE

Research & Development Impact Report No. 1

Developing an appropriate secondary science curriculum for learners working well below age-related expectations

"Stormont House School is a very unique school with a wide range of attainment and students requiring access to the curriculum from KS1 to KS3. I left with the task of changing my practice to deliver a curriculum that catered for the needs of all pupils. Therefore, with help from the Headteacher and SLE a curriculum was devised and now I am able to get the best out of the pupils. Also my practice now draws from primary education as a result of support from the SLE and practitioners from her school."

Faisel Ahmed, Head of Department
Stormont House School

Who might find this research useful?

- Secondary mainstream schools with a significant proportion of learners working well below national curriculum expectations in Science on secondary transfer
- Other special schools or other settings with a similar cohort of learners
- Primary schools interested in developing better transition to secondary in terms of science learning
- Any schools or settings interested in developing the use of the SOLO taxonomy of learning

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Research & Development Impact Report

Area for Research & Development: Science: Teaching, Learning and Assessment

Developing an appropriate secondary science curriculum for learners working well below age-related expectations

Project Participants	Faisel Ahmed (Science Subject Leader) Kate Roberts (SLE) Kevin McDonnell (Headteacher)	Phase(s)	EY/ Pri/ Sec/ Spec/ FE/ All

School context relevant to this research:
Stormont House School is a secondary day special school (11-17)
Students have complex and inter-related special educational needs to the extent that their ability to learn, thrive and develop in a secondary mainstream setting would be significantly affected.
The vast majority of students arrive on secondary transfer from mainstream primary schools and are working within Year 1 or 2 National Curriculum descriptors/ expectations.

Starting point(s):

- The Head of Department (HoD) felt constrained by the KS3 Programmes of Study (PoS) and welcomed the opportunity to develop his knowledge and understanding of earlier stages of learning.
- The existing KS3 curriculum was not matched to the students' skills, learning and experiences in science.
- The Department for Education had confirmed changes to the National Curriculum which the school needed to respond to.
- Existing methods of assessment highlighted what students did not know as opposed to revealing what they did know.
- Assessment mainly focused on recall of knowledge rather than ascertaining how well they were developing skills in the 'working scientifically' strand.
- These factors contributed to an unusual pattern for VA measures of science. It appeared that students made very slow progress in KS3 and rapid progress in KS4, despite being taught by the same teacher. Progress of the same students in other subjects was more even across the key stages.
- Science baseline assessments at the beginning of KS3 also showed much lower attainment than in other subjects.
- The Head teacher saw this as an opportunity to develop a new science curriculum, new approaches for the school's teaching and learning of science and a new framework for assessment.

Key R&D question(s)

How can we match the KS3 science curriculum to the needs of the learners?

As part of this:
How useful is the Solo Taxonomy in supporting the implementation of hierarchical learning intentions?

Is this developing the findings of existing research evidence?

Biggs and Collis (1982) state that SOLO Taxonomy provides a simple and robust way of describing how learning outcomes grow from surface to deep conceptual understanding. Steve Martin (2011) demonstrated how SOLO Taxonomy can be used as a framework for teaching and learning and outlines how to use SOLO in the process of developing learning intentions and success criteria in science.

This research project focuses on creating a curriculum that is accessible for students with a range of special educational needs and varied starting points. The SOLO taxonomy forms the basis for creating a curriculum structured in hierarchical learning intentions. The learning intentions are drawn from the 2014 National Curriculum (NC) programmes of study for KS1, KS2 and KS3.

Intended successful outcomes	**Success criteria/ Impact measures**
• Current practice is reviewed • The school curriculum is developed in the light of the 2014 National Curriculum to better meet the needs of learners • Improvement in the quality of science teaching • An assessment framework is developed, linking in with the 2014 NC • The assessment framework allows more precise judgements about students' attainment to be made, revealing what students do know and how effectively they are developing skills in science	• The Head of Department (HoD) is able to identify aspects of provision that need to be changed and is equipped to make these changes • A new curriculum links KS1, KS2 and KS3 programmes of study • The curriculum utilises hierarchical learning intentions and learning is modelled on the SOLO taxonomy • Observed practice shows a greater emphasis on establishing prior learning and incremental scaffolding with a focus on learning skills. • Teaching draws on students' starting points and prior experiences • Assessment systems are more precise, based on more accessible materials (based on KS1/2 curriculum where appropriate) and moderation shows judgements of pupil attainment to have greater validity

Summary plan of action

- SLE to meet with the Head teacher to discuss the piece of work and agree intended outcomes
- Informal observation of current practice
- SLE to meet with HoD to discuss findings and agree actions, timescales and responsibilities
- Planning meetings – develop new curriculum content and assessment systems
- Implementation gap
- Follow up to observe practice and evaluate the impact of the new curriculum and assessment systems

Initial timescale

Spanning 2 academic years: 2013-14 and 2014-15

Initial resource allocation (human, material and financial)
Head teacher and HoD time for meetings, planning sessions and review of work undertaken.
SLE support
Any other necessary e.g. the purchase of KS1/2 teaching resources and access to resources supporting development and application of the SOLO Taxonomy (see references)
Hackney Assessment Tool (a local authority-led initiative to develop an assessment framework breaking National Curriculum expectations down into descriptors of 'emerging',' developing' and 'secure'

Other points to note
The SLE went on maternity leave academic year 2014-15, so the follow up for this project had a larger implementation gap than initially planned.

HTSA Progress and Impact Review March 2016

Area for Research & Development: Science

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Visible Actions completed or planned

Completed:

- Planning meetings to develop the new curriculum and assessment framework
- Observation of practice including lesson observations, scrutiny of planning, pupils workbooks and assessment records
- Regular meetings with the HoD and Head teacher to share information, report on progress, evaluate and plan next steps
- Evaluation of curriculum planning and assessment framework

Outcomes to date

- The Head of Department (HoD) is developing a greater awareness of the effectiveness of the provision. He can articulate the progress made in terms of implementing the new curriculum, use of the SOLO taxonomy to support differentiation and how this has impacted on learning.
- A new curriculum is in place which successfully links the NC KS1, KS2 and KS3 programmes of study. The curriculum utilises hierarchical learning intentions and learning sequences are modelled on the SOLO taxonomy. In some cases, there could be more opportunities for students to work in the extended abstract.
- Observed practice shows students are developing their skills in making independent choices about investigations. Teaching methods are more effective in meeting the needs of learners as they draw more on their prior learning. Lesson phases are more appropriate in terms of structure and build incrementally, with a focus on skill development.
- There has been a change in the HoD's approach to assessment. Summative assessment is based on appropriate materials which help to determine what students can do, as opposed to highlighting what they cannot. Moderation by senior staff reveals that judgements have greater validity and precision. Formative assessment is developing and students are engaging in self- assessment activities. These could now be refined and linked to the SOLO Taxonomy[1]

[1] Martin, S. (2011), p46

Other outcomes and impact

The HoD states that as a result of the research project, he uses different pedagogical approaches aligned with the students' degree of conceptual understanding.

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His viewpoint is validated by observations made by the project leads. Many of the pedagogical approaches are now drawn from best practice in primary science teaching as defined by Harlen (2008), who suggests the following as the main elements of effective classroom practice in primary science:

- Teachers provide the means for children to collect evidence, which may be through experiment and practical inquiry or from secondary sources.
- Children have the opportunity to express their ideas, to listen to the ideas of others and to build on their existing ideas when faced with new experiences. This means they have shared experiences to discuss, time to do this and, where appropriate, real objects to handle and explore.
- Teachers pose questions that require children to hypothesise, predict and suggest answers.
- Teachers engage children in thinking about and discussing how to test their predictions and see if their ideas 'work'.
- Children are clear about what they are finding out and what they are learning by doing so.
- Children consider the evidence they collect in relation to initial ideas and predictions.
- Children reflect and report on how and on what they have learned.

This approach has fostered greater engagement and facilitates better access to the curriculum.

What next? / Wider learning

- All participants in the research project feel that it would be beneficial to review the curriculum to ensure that there are enough opportunities for students to work in the extended abstract, where the learner has made connections between facts of ideas (relational thinking) and then has linked it with some other concept or theory.
- The impact of the revised curriculum on the previously reported reduced progress and attainment in Key Stage 3 will be reviewed in summer 2016 and 2017.
- It would be possible to link this research project to a wider piece of work on Visible Learning, focusing on student articulation of their learning. For example, can students articulate which level of thinking from the SOLO Taxonomy they feel they achieved?
- Since beginning this project, the school has joined a 3-year programme to develop and embed 'Visible Learning' in the school, which will include developing wider use of the SOLO taxonomy. (The Visible Learning Programme is a joint venture with the secondary HTSA teaching school and will be reported on via the HTSA website)

Review of resource allocation (human, material and financial)

The Head teacher view is that this project required these staffing components in order to be successful:

1. A science teacher/ leader willing to develop and change his practice in light of experience and evidence
2. A Specialist Leader of Education with expertise in both the curriculum and professional development processes
3. Having a Head teacher who is a former science teacher and who also has an interest in the SOLO taxonomy possibly kept the project in focus during the hiatus of the SLE's maternity leave.

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Hackney Assessment Tool (a local authority-led initiative to develop an assessment framework breaking National Curriculum end of year expectations down into descriptors of 'emerging', 'developing' and 'secure' (unavailable outside LA schools, but similar models are available)

Kate Roberts, Kevin McDonnell May 2016

Appendix 1: Extract from revised assessment framework

Science

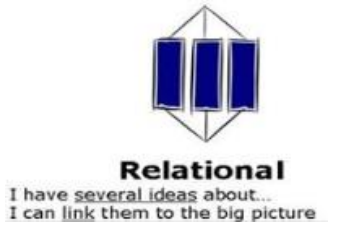
AWLE (Assessment without levels Expectation)
Stormont House School

Pupil Name:

	KS1 (1E to 2S)			KS2 (3E to 4S)			KS2/Y7 (5E to 5S)		
AWLE	Emerging	Developing	Secure	Emerging	Developing	Secure	Emerging	Developing	Secure
Topics	**1E-1D**	**1S-2E**	**2D-2S**	**3E-3D**	**3S-4E**	**4D-4S**	**5E**	**5D**	**5S**
Materials and their properties	Make a list materials	Distinguish between an object and the material from which it is made	Identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock	Identify materials to test	Give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic	Compare and group together everyday materials on the basis of their properties, including their hardness, solubility, transparency, conductivity (electrical and thermal)	Know that all materials are made up of Atoms	Know that the different type of atoms are known as elements and that elements are group in a table called the Periodic Table	Distinguish the properties of metals and non-metals
Animal Cells	List things that are living, dead, and things that have never been alive	Explore things that are living, dead, and things that have never been alive	Compare the differences between things that are living, dead, and things that have never been alive	Make a list of things that keeps animals or plants alive	Know the 7 characteristics of living things	Outline role of the 7 characteristics of living things	Cells as the fundamental unit of living organisms, including how to observe, interpret and record cell structure using a light microscope	The functions of the cell wall, cell membrane, cytoplasm, nucleus, vacuole, mitochondria and chloroplasts	The similarities and differences between plant and animal cells Classify and describe specialised cells (blood, sperm, nerve cells…)
Plant Cells	Draw a basic structure of a variety of flower or tree	Identify the basic structure of a variety of common flowering plants, including trees	Describe the basic structure of a variety of common flowering plants, including trees	Identify where plants get the water from?	Describe that water moves from the roots to the leaves.	Investigate the way in which water is transported within plants			

(Extract by permission)

Appendix 2: Extract from Year 7 Chemistry Scheme of Work: AWLE: 1E-5S **Title:** Material Properties

Scenario:	**Introduce scenario:** Mr. Ahmed is cross because his carrier bag had split open. Can you help him find a stronger bag?		**Develop scenario:** Mr. Ahmed is having a really bad day because the light in his house is broken. Can you help him find a suitable metal to take home and repair?			
KS1 Objectives	**KS2 Objectives**	**KS3 Objectives**	**Main content**	**Level of thinking and learning**	**Assessment/ AFL opportunities***	**Key Vocabulary**
Distinguish between an object and the material from which it is made Identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock Describe the simple physical properties of a variety of everyday materials Compare and group together a variety of everyday materials on the basis of their simple physical properties. Identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses	Give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic Compare and group together everyday materials on the basis of their properties, including their hardness, solubility, transparency, conductivity (electrical and thermal)	To understand the Periodic Table: periods and groups; metals and non-metals To know the properties of metals and non-metals	Look at a collection of objects (plastic bag, box…) and name them.		Observation Experiment Standard Test Brainstorming/Q & A	Metals Non-metals Properties Materials Plastic Wood Conductivity Hardness Solubility Transparency
			Define materials used to make the objects (plastic, rubber, wood, metals..)			
			Properties of the materials used to make the object (hard, soft, transparent, flexible, rigid…)			
			Venn Diagram: Sort objects by the material used and their properties Compare the physical properties of materials **Hooke's law**: compare strength of plastic bags to solve a problem **Experiment:** Look at the conductivity of metals and non-metals e.g. build a circuit using a battery, bulb and crocodile clips... Write results in a suitable table or teacher can provide table.			
			Design a product that can be used in everyday life using knowledge of properties of materials. **Extension:** Now design a silly product and ask they used those materials (chocolate teapot…)