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Written Assignment 2: Develop a unit or scheme of work which requires you to learn new subject knowledge.

Context and focus

This assignment examines how a scheme of work supports continuity and progression, two of the key objectives in the KS3 National Strategy. Having developed the scheme of work into plans for learning, I will discuss how these plans give opportunities for accelerated learning and challenging alternative frameworks. My assigment focuses on the KS3 module Electricity 1, which is roughly equivalent to the Year 7 Electrical Circuits module in the QCA (2000) framework. Within this module I will consider the first four lessons, which I will be teaching a middle-ability set. (See Appendix 1 for an annotated Scheme of Work.)

The role of a scheme of work

Lessons planned in isolation from a scheme of work can suffer from several faults. I will discuss three, which I have called unwanted evolution, 'flooding' and progression, and show how a scheme of work helps to prevent them. Unwanted evolution is the process by which a lesson veers away from its original aims, as a teacher notices possibilities for other learning in the topic. A scheme of work promises that the 'other learning' will be covered in other lessons, and so refocuses the lesson plan on clear objectives. 'Flooding' is a problem of over-enthusiasm: how can we address each aspect of scientific enquiry, citizenship, numeracy, ICT, literacy, different learning styles and multiple intelligences in a single hour? The scheme of work is invaluable in giving an overview of the module, allowing the teacher to pick out key opportunities for addressing these, and checking that all are covered at some point. Progression can be difficult to notice in an individual lesson, as students rarely experience large leaps in cognitive skills or content knowledge. Nonetheless, perceived lack of progression is frustrating for teachers and learners. Schemes of work allow both to reflect over a longer timescale and to notice how imperceptible changes contribute to visible changes over time.

Continuity and progression

Continuity and progression are key concepts in education, but the two are often confused. The KS3 National Strategy defines them:

> "continuity extends pupils' experiences without unhelpful repetition. Progression refers to the step-wise development of scientific concepts and techniques." (DfES, 2003, p22)

Schemes of work play a pivotal role in supporting continuity and progression. They organise the national curriculum content into a 'spiral curriculum', ordering the material with reference to increasing cognitive difficulty and thematic continuity. Students return to the same skills and concepts, demonstrating their new understanding. Asoko and Squires (1998) discuss strategies for enhancing progression and continuity. Appendix 1 is annotated to show how the scheme of work supports progression through the curriculum and maintains continuity between and within units.

Schemes of work should provide a connected pathway through a topic and be correlated closely with the individual lesson plans to ensure continuity and progression. They enable an overview of the topic and can provide a useful checklist of considerations for planning. Developing a scheme of work into lesson plans remains essential: it tailors learning to a particular class and to the learning process of individual children. Two factors that are particularly relevant in lesson planning are accelerated learning and alternative frameworks. Accelerated learning is concerned with effective learning strategies to support progression, and alternative frameworks act as a barrier to progression. See Appendix 2 for lesson plans, annotated to highlight practical examples of contributions to accelerated learning and challenging alternative frameworks.

Accelerated Learning

'Accelerated learning' theory suggests that a student can learn to learn. When accelerated learning techniques are applied in the classroom, the effectiveness and durability of learning improves dramatically. Discussion of the AL (accelerated learning) cycle, implications and applications can be found in Smith (1998). My understanding of this cycle has been summarised in a mindmap. **(Appendix 3.)** My school works within the AL framework, and displays the AL cycle in each classroom. **(See Appendix 4.)**

My first response to AL was a change in my lesson plan structure. Prior to this assignment, I used the three-stage approach (starter, main body, plenary) recommended by the KS3 National Strategy. This encouraged a variety of activities, and emphasised introductions and reviews. However, the principles of the national strategy are actually more compatible with the framework of my lesson plans (Engage and Connect, Activate, Demonstrate, Consolidate). The new structure shows that effective learning relies on a process, as well as a variety of activities: learning occurs when activities are relevant to both the content and process of learning. This change counters the temptation to pick an irrelevant starter for the sake of engagement: excellent starters are engaging but also contribute to learning. It also ensures that review and demonstration are not left behind in a doomed 'short-cut' attempt to cover more material. For example, I changed the first activity in Lesson 2, as my original idea was a quiz on electricity in everyday life, which was only tangentially related to the learning objectives. I restructured Lesson 3, shortening the practical time and using students as teachers, which left time for whole-class consolidation. Evaluation of my ideas is particularly easy, as the adjacent column contains the stage of learning and the learning objectives if appropriate.

Beyond the application of structure, particular points in AL are worthy of further mention. In the Connection phase, schemes of work are useful in contextualising a lesson within a topic. These schemes, restricted by the necessarily linear progression of lessons in time, can be reworked into a mindmap that emphasises interconnections between lessons. When undertaken by students, this work also provides extra Consolidation. I have used a similar brainstorming technique in Lesson 1 (Appx 2) which allows students to summarise (Consolidate) the class's understanding of electricity and then Connect the Learning to the next few lessons.

The table below matches a few features of AL to their practice. This assignment does not allow for in-depth discussion, so further details are found in the annotated lesson plans. **(Appendix 2.)**

AL theory	Classroom strategies
Learning should be contextualised with reference to what is already known, and what will be learnt.	Brainstorm (Lesson1) Connect the Learning (each lesson)
Metacognition enhances learning.	Brainstorm (Lesson1) Reflection (Lesson 4 homework)
Memory improves when learning (a) is experienced via multiple senses (b) involves doing and discussing	Practical activity planned in each session. Variety of learning styles used (eg Lesson 4 Activate)
The best way to reinforce learning is to teach someone else	"Each one teach one" technique used to teach voltage (Lesson 2)
Learning is enhanced when students engage with the material and consider its meaning and relevance.	Models of electricity with justifications (Lesson 2) Active reading on voltage (Lesson 2)

Metacognition, or 'thinking about thinking' is a major feature of AL. Two brainstorms, at the start and review of a set of lessons, were used for students to identify the progression of their understanding. Reflection on learning develops an awareness of cognition in the students, which is invaluable to the teacher as he extends and challenges prior learning. In many cases, this requires a re-modelling of the pupil's thought in order to move away from their alternative frameworks.

Challenging alternative frameworks: models of electricity

> *"It seems that many strategies designed to help pupils understand electricity actually introduce and reinforce problems."* (Driver, Squires, Rushworth and Wood-Robinson, 1994, p117)

Electricity lends itself to metaphor, analogy and even animism. The flow of electricity is likened to the flow of water, electrons in a circuit to marathon runners and so on. This approach is problematic: by introducing electricity through analogy to concrete phenomena, we can cause dependence on the analogies and thus generate confusion, rather than understanding. For example, students often talk about electrons coming from the battery and moving sequentially. This model, often implied unintentionally, can lead to questions of how the electrons 'know' which way to go in parallel circuits.

During this assignment, I have developed my subject knowledge through considering alternative frameworks and models of electricity. My notes, including counterexamples to create cognitive conflict, are in **Appendix 5**. Common alternative

frameworks for electricity are documented: a summary is found in Driver et al (1994). Less well documented are the alternative conceptions of teachers: Bano and Harcharan (2001) showed that physics teachers in Pakistan lacked a clear understanding of electrical circuits, leaving them without the skills to enlighten their equally confused students.

Testing my own conceptions, I found that my 'knowledge' about electricity varied between contexts. As a chemistry graduate, I understood current as a flow of free electrons through a conducting material, under the influence of an electric field, moving towards low potential. As a KS3 teacher, though, I understood current through a sequential model, with electrons starting at the battery, as implied by textbooks. My inherited concepts of 'simplified science' had not been replaced by a simplified version of the 'sophisticated science' I learned at university. It was easier to fall back on faulty but existing models than to reframe and simplify my university knowledge. My research has helped me to begin the reframing process, but how should I use my newfound expertise to help my students?

Elicitation activities are the primary tool for investigating alternative frameworks. I incorporated several activities that are designed to draw out alternative frameworks, including two described in **Appendix 6** that were adapted from research by Kibble (1999). The Scheme of Work suggested challenging misconceptions by asking students to develop own analogies of electricity. I adapted this to make it more accessible, creating a template for the answers. The extension tasks challenge the students to think critically about the models they have suggested, which is also a technique of both accelerated learning and scientific enquiry. Lesson planning often involves combining several learning objectives or several learning techniques within the same activity, a feature I had not appreciated before this assignment.

Impact on Professional Development

This assignment helped me to consider the multitude of factors that are important in effective learning, and therefore in lesson planning. At times it was difficult to retain a sense of the whole lesson while focusing on particular aspects. It was also easy to forget where particular lessons fitted into the scheme of work: to see the lesson as an isolated learning experience instead of a small part of a progression. Constant referral

to the scheme of work now informs my lesson planning. Through this assignment, I have gained further experience of lesson planning and begun to appreciate the complementary role of schemes of work.

Consideration of accelerated learning techniques and alternative frameworks held by the students challenged me to adapt my lesson plans by including opportunities for both. Throughout this commentary I have shown how my attitudes and behaviours have changed as a result of my research into the two areas. Accelerated learning is immediately applicable to each lesson, and my work on alternative frameworks will support topic areas, as well as imbuing my lesson planning with a consideration of prior learning and experience (as contrasted with prior teaching). It could be argued that this limits the role of planning, since lessons must be adapted to the information elicited from students regarding their knowledge from previous lessons. I disagree: only a lesson that is well planned, encompassing subject confidence and a variety of learning experiences, has the freedom and flexibility to cope with the unexpected.

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Appendices

Appendix 1: Scheme of Work
Appendix 2: Individual Lesson Plans
Appendix 3: Accelerate Learning MindMap
Appendix 4: Accelerated Learning Cycle (Classroom Poster)
Appendix 5: Challenging Misconceptions: notes
Appendix 6: Resources for challenging misconceptions