WORKING TOWARDS BIG IDEAS: IMPLICATIONS FOR THE CURRICULUM, PEDAGOGY & ASSESSMENT

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The need to define a set of 'big ideas' as a framework for decisions about the curriculum, pedagogy and assessment originated in the context of science education. For many years there had been calls for greater depth and less uncoordinated breadth in this field. Multiple problems stemmed from the curriculum being overcrowded with content, allowing insufficient time for understanding through inquiry-based learning. Assessment dominated by tests of disconnected facts added to the perception of science as fragmented, and encouraged memorisation rather than understanding. As a result, many students did not see their science education as interesting or relevant to their daily lives.

A major part of the solution was to conceive the goals of science education not as a collection of facts and theories, but rather as progress towards a relatively small number of key ideas that are most worthwhile and relevant to students' lives during and beyond school. A set of such ideas would provide a map for curriculum developers and teachers to select or create significant learning experiences from the enormous range available.

Creating a reduced and more coherent curriculum framework meant asking: what are the most important ideas that students should encounter in their science education to enable them to understand the natural world? In 2009 a small international group of expert scientists, science educators and engineers met in Scotland to address this question. The result of this two-and-a-half-day seminar was the publication of *Principles and Big Ideas of Science Education*, which was widely circulated and translated into several languages. Five years later, the same group met to set out in more detail the rationale for working with big ideas and to consider the implications for curriculum content, pedagogy and student assessment. The outcome was *Working with Big Ideas of Science Education* (Harlen, 2015).

Progression from small to big ideas

Before going further, we need to be clear about what is meant by a 'big' idea and how it differs from a 'small' idea. An idea described as 'big' applies to a wide range of related events or phenomena, while a 'small' idea has limited application to specific objects or events. For example, the idea that the features of earth worms enable them to thrive underground is a small one, which becomes larger as other living things are studied, developing into a generalisation that applies to all organisms. Big ideas are not taught directly but are built from small ideas linked together. They are sometimes described as 'powerful' because they have greater explanatory power in helping learners to understand the world.

Identifying the nature of progression from small to big ideas is central to setting out what students should be learning at various points as they move through their school years.

In the case of science education it was decided to express the progression towards each big idea as a story or learning 'journey'. Using sentences avoids listing topics or concept labels ('heat', 'magnetism', 'reproduction', etc.), which determine content and activities. The narrative form fills in the gaps between parts of the story without assuming that the steps in the progression are exactly the same for everyone.

For each big idea, the story begins with the small and contextualised ideas that children in the primary school, through appropriate activities and with support, will be able to grasp. These are followed by ideas that lower secondary school students can develop as their increasing capacity for abstract thinking enables them to see connections between events or phenomena. As exploration of the natural

world extends in secondary education, the continuation of finding patterns and links enables students to understand relationships and models that can be used in making sense of a wide range of new and previous experiences. What matters is the general direction of progression towards useful ideas that become gradually more powerful in explaining the scientific aspects of the world.

The full progression stories for these ideas can be freely downloaded from the Association for Science Education website at www.ase.org.uk/resources/big-ideas.

Big ideas in other areas of learning

The need to restructure the curriculum to provide for greater depth in learning is not confined to science education. Similar criticisms about lack of coherence and assessment of disconnected facts apply to other areas of learning. So, when the Welsh government set out to revise the whole curriculum, the notion of a framework based on big ideas was put to the test. The purposes and general structure of the curriculum were identified by Professor Graham Donaldson in a report to the Welsh government entitled *Successful Futures* (2015), which was accepted as a guide in the development. The report recommended a curriculum organised into six areas of learning and experience (expressive arts; health and wellbeing; languages, literacy and communication; mathematics and numeracy; and science and technology) and three cross-curricular responsibilities (literacy, numeracy and digital competence). Working groups of 'pioneer' teachers were set up to consider how to define the six areas and develop the learning within each. This work is on-going. However, building on the experience in science, the impact on curriculum content, pedagogy and assessment can be anticipated as follows.

Curriculum content

A central part of the rationale for identifying big ideas is that they provide guidance in the selection of curriculum content, with the aim of ensuring that students' activities are the most worthwhile for their learning and make best use of precious and limited classroom time. *Working With Big Ideas in Science Education* (2015) lays out principles to guide the development of learning experiences, and proposes, for instance, that activities should develop and sustain curiosity; promote enjoyment of scientific activity; be seen by all students as interesting and relevant to their lives; develop scientific understanding, skills and attitudes; and enable them to make informed decisions that care for the environment and affect their own and others' wellbeing.

Successful Futures expresses similar general criteria for the whole curriculum in Wales. These are to develop:

- Ambitious, capable learners, ready to learn throughout life.
- Enterprising creative contributors, ready to play a part in life and work.
- Ethical, informed citizens of Wales and the world.
- Healthy, confident individuals, ready to lead fulfilling lives as valued members of society (Donaldson, 2015: p.55).

Pedagogy

Clearly, achieving such purposes and progressing towards big ideas depends on far more than the content of activities. In particular, it depends on how activities are organised, the role of the teacher and how progress in learning is scaffolded – that is, on pedagogy. Current understanding of how learning takes place emphasises the active participation of students and the importance of discussion and dialogue in developing ideas with others. The teacher's role is to encourage this through providing materials that can be investigated, asking questions that reveal the skills and ideas that students already have, making opportunities for group discussions, supporting trial of alternative ideas and making time

for reflection on what has been learned and how. Several of these features of pedagogy are associated with using assessment to help learning.

Assessment

In progressing towards big ideas, assessment serves two main purposes: to help learning (formative assessment) or to summarise and report learning (summative assessment). Formative and summative assessment differ in terms of purpose, rather than form.

'Formative assessment is a process of seeking and interpreting evidence for use by learners and their teachers to decide where the learners are in their learning, where they need to go and how best to get there' (ARG, 2002).

It is best thought of as a cycle of events starting from what students already know and can do, and informs decisions about the steps needed to make progress. The next steps are those that enable students to achieve short-term lesson goals, which then take them towards longer-term goals, including understanding big ideas.

Feedback has a key role in formative assessment, since it is the means of using evidence of current learning to help further learning. Involving students in this process, by helping them to understand the goals of their work and standards to aim for, enables them to take some responsibility for, and reflect on, their learning. Feedback from teachers should give students information they can use to take their learning forward. Feedback into teaching means that teachers can use observations of students and their work to adjust the challenges they provide for students. Judging students' ability to take certain steps facilitates the regulation of teaching so that the demands of activities are neither too great – making success out of reach – nor too simple to be engaging.

Summative assessment, which can only be treated briefly here, differs from formative in purpose, timescale and frequency. It refers to the achievement of longer-term goals, and is occasional rather than integral to teaching. Because it is used for reporting learning to others as well as to teachers and students, it requires more attention to reliability . However, although not defined in terms of direct impact on learning, all assessment should ultimately help learning.

Conclusion

Curriculum content, pedagogy and assessment – three key components of students' educational experience that influence their learning – are not independent of each other, but closely interrelated. In consequence, we need to consider implications for all three elements when we review and revise any one of them. A change such as framing the curriculum in terms of big ideas and broad competencies will not have the intended effect of increasing depth of learning if assessment requires memorisation of multiple facts, or if pedagogy fails to forge the links necessary to form these big ideas. Similarly, there is no point in advocating active, inquiry-based pedagogy and students taking responsibility for their learning if there is an overbearing assessment system and no time for reflection. Achieving ambitious purposes requires content that students see as relevant and enjoyable challenges, pedagogy that acknowledges individual starting points and assessment that is used to help learning.