



CROSS-CURRICULAR
TEACHING AND LEARNING IN
THE SECONDARY SCHOOL

.....

THE ARTS

DRAMA, VISUAL ART, MUSIC AND DESIGN

A **David Fulton** Book

MARTIN FAUTLEY AND JONATHAN SAVAGE

CROSS-CURRICULAR TEACHING AND LEARNING IN THE SECONDARY SCHOOL THE ARTS

The school curriculum is a contested arena. There are competing pressures from those who advocate that it should be constructed on a subject specific basis, whereas at the other end of the continuum is the stance taken by this book, that learning, and especially learning in the arts, can transcend artificial boundaries between subjects. This book sets out a case for cross-curricular learning involving the arts in secondary schools where teaching and learning really matter.

Cross-Curricular Teaching and Learning in the Secondary School ... The Arts argues for the development of a new, skilful pedagogy which embeds an authentic, cross-curricular approach to teaching and learning in the work of the individual teacher. This approach respects and builds on individual subject cultures within the arts, whilst embracing and exploring links between subject knowledge and subject pedagogies in an enriching way. It focuses on the powerful nature of cross-curricular thinking to produce a joined-up model of teaching and learning where teachers are empowered to think about creative pedagogies, and pupils are able to engage in deep learning as a result.

Key features of the text include:

- Theoretical examination of key issues
- Curriculum planning materials and resources
- A wide range of case studies drawn from innovative practice
- Frameworks for assessment and evaluation.

Part of the *Cross-Curricular Teaching and Learning in the Secondary School* series, this textbook breaks the boundaries between curriculum subjects and the arts. It is timely reading for all students on Initial Teacher Training courses as well as practising teachers looking to introduce cross-curricular themes in their own subjects.

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Cross-Curricular Teaching and Learning in . . .

Series Editor: Jonathan Savage (Manchester Metropolitan University, UK)

The *Cross-Curricular* series, published by Routledge, argues for a cross-curricular approach to teaching and learning in secondary schools. It provides a justification for cross-curricularity across the Key Stages, exploring a range of theoretical and practical issues through case studies drawn from innovative practices across a range of schools. The books demonstrate the powerful nature of change that can result when teachers allow a cross-curricular 'disposition' to inspire their pedagogy. Working from a premise that there is no curriculum development without teacher development, the series argues for a serious re-engagement with cross-curricularity within the work of the individual subject teacher, before moving on to consider collaborative approaches for curriculum design and implementation through external curriculum links.

Cross-curricular approaches to teaching and learning can result in a powerful, new model of subject-based teaching and learning in the high school. This series places the teacher and their pedagogy at the centre of this innovation. The responses that schools, departments or teachers make to government initiatives in this area may be sustainable only over the short term. For longer-term change to occur, models of cross-curricular teaching and learning need to become embedded within the pedagogies of individual teachers and, from there, to inform and perhaps redefine the subject cultures within which they work. These books explore how this type of change can be initiated and sustained by teachers willing to raise their heads above their 'subject' parapet and develop a broader perspective and vision for education in the twenty-first century.

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Drama, Visual Art, Music and Design

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Abbreviations

AfL	Assessment for Learning
APP	Assessing Pupils' Progress
ARG	Assessment Reform Group
C Standards	Core standards
CD	Compact disc
CPD	Continuing professional development
DfEE	Department for Education and Employment
DJ	Disc jockey
FMS	Federation of Music Services
GCSE	General Certificate of Secondary Education
H-creative	Historically creative
ICT	Information and communication technologies
IQ	Intelligence quotient
ITT	Initial teacher training
KS	Key Stage
MC	Master of Ceremonies
MIDI	Musical instrument digital interface
n.d.	No date
NACCCE	National Advisory Committee on Creative and Cultural Education
NAME	National Association of Music Educators
NASAGA	North American Simulation and Gaming Association
NCC	National Curriculum Council
NFER	National Foundation for Educational Research
Ofsted	Office for Standards in Education, Children's Services and Skills
PCK	Pedagogic content knowledge
P-creative	Psychologically creative
PGCE	Postgraduate Certificate in Education
PLTS	Personal, learning and thinking skills
Q Standards	Qualified teacher status standards
QCA	Qualifications and Curriculum Authority

QCDA	Qualifications and Curriculum Development Agency
RE	Religious education
SEAL	Social and emotional aspects of learning
S-R	Stimulus-Response
SSAT	Specialist Schools and Academies Trust
TA	Teacher assessment
TDA	Training and Development Agency
TEEVE	Tele-immersive Environment for EVERYbody
UK	United Kingdom
WPU	Witness protection unit
ZPD	Zone of proximal development

Introduction: the context for cross-curricular teaching and learning

Key objectives

This chapter will introduce a number of key themes for cross-curricular teaching and learning. By the end of this chapter you will have:

- Defined what is meant by a cross-curricular approach to teaching and learning
- Thought about knowledge, and considered what knowledge means in a variety of contexts
- Reflected on the cross-curricular dimensions contained within the National Curriculum
- Considered planning for learning
- Begun to think about the role of assessment
- Considered the key role of creativity
- Reflected on the nature of self and identity

What is cross-curricular teaching and learning?

A cross-curricular approach to teaching is characterised by sensitivity towards, and a synthesis of, knowledge, skills and understandings from various subject areas. These inform an enriched pedagogy that promotes an approach to learning which embraces and explores this wider sensitivity through various methods.

(Savage 2011: 8–9)

This book is about cross-curricular approaches to teaching and learning in the arts. It does not stand alone. As part of a series of books on cross-curricularity in secondary education, it forms an integral part of a web of ideas drawn from the work of eight authors and teachers – each with their own subject allegiances and backgrounds – who have found cross-curricularity to be a vital, driving aspect of their work in recent years.

This definition for a cross-curricular approach to teaching and learning is drawn from the generic title which forms the basis for this series of books (Savage 2011). Key words within this definition, such as *sensitivity*, refer to the ways in which teachers should approach the knowledge, skills and understanding inherent within every curriculum *subject*. Each curriculum *subject* is exemplified in curriculum documents but also has a historical legacy that is underpinned in various ways, not least in teachers' and others' conceptions about a particular *subject* and how it should be taught. Understanding this is a vital step that needs to be taken before moving into collaborative curriculum ventures. Cross-curricular approaches are about *synthesising* ideas, but this should not be done in a way that destroys the cherished ideas and ways of thinking that every *subject* contains. Rather, this definition for cross-curricularity encourages the development of an *enriched* pedagogy that a skilful teacher can adopt for the explicit purposes of enhancing teaching and learning. The new, *enriched* pedagogy of cross-curricular teaching will *embrace* and *explore* the teacher's *sensitivity* towards, and *synthesis* of, the different knowledge, skills and understanding within curriculum *subjects*. In order for this to happen, there are at least two premises: first, teachers will need to understand their own intrinsic, and their subject's, 'subjectivities'; second, teachers will need to ensure that their subject knowledge is extended beyond their own subject areas. When this occurs, teachers will be in a position to develop a cross-curricular approach to learning that utilises a range of methods or techniques in line with the following principles and purposes.

What cross-curricular teaching and learning in the arts entails

A key question for educators is how to organise schools so that learning and teaching are most effective. New ways of teaching and learning, and new ways of knowing, are part of the constant technological revolution that is the constant backdrop against which twenty-first century young people will conduct their lives. This revolution in information, where the Internet means that a huge amount of information and content is available at the touch of a few keys has changed the way society thinks about knowledge, and, importantly, what it means to 'know'. In this book we shall consider how cross-curricularity in the arts can be at the forefront of developments, and how such matters as personalisation, collaboration, and creativity can be nurtured in young people in schools, colleges and society generally. To do this we shall consider what learning and knowledge are, how they can best be fostered and developed, what the roles of the teacher are in this, and how best to develop the individual students towards their maximum potential. This sometimes involves asking some difficult questions, and we shall not shy away from doing this!

Let us begin by considering what cross-curricular teaching and learning in, and through, the arts entails. To do this we need to start by exploring the notion of curriculum, in order to understand how the current situation arose, and what it might mean to contemporary understandings of the way we organise learning and teaching. According to Bernstein,

Formal educational knowledge can be considered through three message systems: curriculum, pedagogy and evaluation. Curriculum defines what counts as valid knowledge, pedagogy defines what counts as a valid transmission of knowledge, and evaluation defines what counts as a valid realization of this knowledge ...

(Bernstein 1971: 47)

This notion of ‘what counts as valid knowledge’ is an important one for us here. We shall, in the course of this book, consider the various aspects raised by Bernstein, of knowledge, of pedagogy, and of evaluation, which for our purposes in today’s climate we shall consider alongside assessment. However, to return to our discussion of curriculum, the ways in which it is organised vary from country to country, from region to region, and from school to school. We also that know that:

... curriculum is inextricably linked to social context. Broad historical, cultural, economic and political forces inter-relate to form and shape teaching and learning.
(Moon and Murphy 1999: 1)

What this means for us is that the way things are organised will be different according to time and place. Let us begin by considering some particular aspects which relate to you, the reader, with regard to this.

Reflective task

Part 1: What is your job title? Are you, for example, a ‘teacher of art’, or maybe ‘head of drama’? Is this all you do?

Part 2: What route did you take to get to this position? What qualifications did you take at school? What subject is your degree in?

How do these relate? Have you followed a linear pathway and career route, or have there been other things you have done along the way?

Historical note

In the UK, the National Curriculum was for many years seen as the defining feature of school curricular organisation, or according to some, a straitjacket for the containment and demarcation of knowledge. The original architects of the National Curriculum decided which subjects would be included – ten in total – and then gave the job of deciding what would be included in each of the ten subjects to ten different authoring committees.

... the National Curriculum was set up subject by subject through a series of working parties. Cross referencing between working parties, made up of government nominees, was discouraged and the setting up and reporting took place at different times ...
(Moon 1995: 257)

The arts were viewed as separate subjects by the original designers, with art and music, but not drama or dance, included in it. However, the very inclusion of art and music was contested at the time. Tony Taylor writes of how the then education secretary, Kenneth Baker, was ‘furious’ at the then prime minister’s (Margaret Thatcher) attempt to ‘... drop art and music from the curriculum’ (Taylor 1999: 42). Art and music remained, but, owing to the complexities outlined by Bob Moon above, had virtually nothing to do

with each other. Indeed, in the case of music, the content of the programme of study for the National Curriculum was subject to some vitriolic exchanges, played out mostly in the pages of the national press:

Despite the opposition of many leading music educators and musicians, led by conductor Simon Rattle, the curriculum was weighted towards musical theory and appreciation rather than practical activities.

(Moon 1995: 258)

We shall revisit the introduction of the National Curriculum in Chapter 2, but for the moment we need to note this concern for the content of curriculum reminds us that education is a political issue, and that content of curriculum, Bernstein's 'valid knowledge', has to be decided by someone. This begs the question: whose knowledge is valid? What makes it so, and who are the validators? Owing to the fragmented way in which the National Curriculum was drawn up, opportunities for cross-curricular linkages, or even for commonalities between subjects, were distinctly limited. However, there were *cross-curricular themes*, and these were designed to be spread across all subjects, and consisted of

... elements that enrich the educational experience of pupils. They are more structured and pervasive than any other cross-curricular provision and include a strong component of knowledge and understanding in addition to skills. Most can be taught through other subjects as well as through themes and topics.

(NCC 1989: 6)

The cross-curricular themes they were referring to included economic and industrial understanding, health education, environmental education and citizenship. In addition to cross-curricular themes, there were also *cross-curricular skills*, which included communication, numeracy, problem solving, information technology and study skills. A problem at the time was that these were seen as something of a 'bolt on' accessory, rather than central to the curriculum. There was a concern that this would lead to these elements not receiving the attention they deserved:

The sheer rate of change that is taking place in education is unprecedented. The volume of paper reaching schools and requiring responses is daunting, even to the most committed professional. The core and other foundation subjects are currently centre-stage. Unless teachers and schools are vigilant, the benefits of cross-curricular themes could be adversely affected.

(Pumfrey 1993: 21)

The atomistically designed National Curriculum meant that there just was not enough time to deal with the cross-curricular themes and skills. As David Hargreaves observed:

... greater breadth was a key purpose behind the National Curriculum reforms. As all teachers know, the broader the curriculum becomes, the greater the problem of manageability. The problem is easily stated: how to get the quart of a desirable

curriculum into the pint pot of the school timetable ... How, then, did they [the curriculum designers] achieve the trick of getting the quart into the pint pot? By sleight of hand, of course ...

(Hargreaves 1991: 36)

The 'sleight of hand' to which Hargreaves refers was by telling teachers that they could teach all of the themes through existing subjects, even though teachers were complaining that there was too much content already, and the committees who had designed the content had not included the extra material. The result of this led to what Bob Moon called 'complex and retrospective attempts to achieve cross-curricular coherence' (Moon 1995: 259). It is likely that these early problems clouded the ways in which teachers thought about cross-curricular matters, and this has, to some extent, caused some teachers to retreat into entrenched subject-based positions in order to make sense of their workloads.

However, recent curricular developments have freed this up to a considerable extent, with the latest version of the National Curriculum being explicit about being amenable to local variations. What this has meant is that the old ways can now be challenged and rethought, which is precisely what we will be doing in this book.

Curriculum development and the teacher

Reflective task

In the last reflective task, we asked you to think about your current position, and the route you took to arrive at it.

Now, think about how much of your current position entails dealing with things *other* than your main subject. Do you, for example, teach aspects of literacy? Of numeracy? Maybe you have to deal with personal and social aspects of learning, for example in dealing with group work? What else do you do?

It is likely that you do a wide range of things beyond your subject specialism!

In the accompanying over-arching book to this one (Savage 2011), three key themes are suggested which have a significant impact upon curriculum. Summarised briefly, these are:

1. What is meant by 'curriculum development' and could it be linked to my own development as a teacher?
2. Why is it important to develop a sense of my own 'subjectivity' and how would this relate to curriculum development and the construction of a skilful pedagogy underpinned by reflective practice?
3. How explicitly are learning and teaching linked together?

From these three themes, a number of significant issues emerge which we shall consider with relation to cross-curricular work in the arts.

This section began by asking you to think about the multiplicity of aspects to your current role which can be seen to be beyond the subject specific. This was purposefully undertaken in order to establish the breadth of roles which teaching entails. Indeed, we can go further:

Reflective task

One PGCE course leader says teaching involves the following roles:

Nanny; Lawyer; Referee; Mediator; Supporter; Role Model; Advisor; Guide; Police Officer; Probation Officer; Judge; Counsellor; Social Worker; Mentor; Moderator; Coach; Director; Jailer; Facilitator; Leader; Supporter; Confessor; Pacifier; Trail Blazer; Motivator; Controller.¹

How many of these roles have you fulfilled recently?

In order to undertake these you will have received some training, either in initial teaching training (ITT), as a result of continuing professional development (CPD), or, quite possibly, no training at all, and these are things which you have had to pick up as best as you can en route. This takes us to the first of the three general principles above, possibly expounded best by Laurence Stenhouse, who observed that there can be 'no curriculum development without teacher development' (Stenhouse 1980: 85). Stenhouse placed the teacher firmly at the centre of educational development and reform, and it is this principle which clearly derives from the first of the three key themes above. We began this chapter by thinking about curriculum, and curriculum development is a key theme of this book. Curriculum development, as Stenhouse observed, begins with the teacher, and so we have been thinking, and will continue to think about your role in this, and what you could do to develop yourself in terms of your teaching, and the curriculum. This thought takes us to the second of our main principles, that of pedagogy.

Pedagogy

The notion of pedagogy is an important one, and will form one of the central components of this book. The classification of pedagogy we will be using is this:

Pedagogy is the art and science of teaching.

Whether you are a beginning or an established teacher, you will have been developing your own pedagogy, and will have evolved a variety of ways in which you teach various topics. We will discuss pedagogy in detail in Chapter 3, but for the moment it is useful to note that what we are referring to by the terminology includes not only ways in which teaching takes place, but also ways in which your own ideas, knowledge and background impinge upon your teaching. There is an old proverb which states that some people have

five years of experience, others have one year's experience five times! This can be particularly true in secondary school teaching, with its annual cycle of timetables delineating regular teaching and learning. We want you to build upon your experiences, and add to them, and so although pedagogy will feature consistently in our discussions, we hope that this will also be enacted in your professional practice, that you will be trying out new ideas, and reflecting upon what you have done.

Learning and teaching

A common lament in staffrooms is 'I don't know why they haven't learned it, I've taught it to them a thousand times!' This cry neatly sums up the issue. Teaching does not entail a direct one-to-one mapping onto learning. If it did, people would only need teaching something once, and it would be there for life. This is clearly not the case, and it can be a mistake to assume that there is a straightforward linear relationship between the two. We shall revisit teaching and learning a number of times in later chapters, especially Chapter 3, and try to uncover some of the more complex issues that arise, including both theoretical and practical considerations. We shall also be challenging you in a metacognitive fashion to think about your own thinking concerning teaching and learning, how this has been formed and shaped, and how you enact teaching for learning on a daily basis within your professional work.

The National Curriculum in the UK

In the UK, the National Curriculum, as we saw above, is the key framework for organising teaching and learning in schools. We discussed some of the problems that arose with the original version of the National Curriculum, and now we are going to turn our attention to more recent versions, and how they have altered the ways that teaching and learning can be thought about.

Practical task

Without looking at it, can you say what parts of the National Curriculum for your subject are most important a) for you, b) for the students?

The National Curriculum, however, is more than just the specification for the subjects which you teach. Having learned from the problems with the original National Curriculum, the more recent version has provided a common framework for all subjects. This means that when you look at the layout for each subject they are all broadly similar, involving Key Concepts, Key Processes, Range of Study, and Curriculum Opportunities. This allows for ready comparison between subjects, and indeed, the web-based versions encourage the reader to do just that. In addition to this subject-based approach to teaching and learning, the QCDA have developed a 'big picture' of the curriculum (QCDA 2010), which shows that there are a considerable number of curriculum elements which need to be considered, of which individual subjects are but a single component. Each subject has a section entitled 'Wider Opportunities', and this section makes links between the

subject in question, and other areas of the curriculum. These elements are part of the subject orders, and so in that sense can be considered as statutory.

Aside from subjects, other elements which go to make up 'the big picture' are non-statutory 'cross-curricular dimensions'. These include:

- Identity and cultural diversity
- Healthy lifestyles
- Community participation
- Enterprise
- Global dimensions and sustainable development
- Technology and the media
- Creativity and critical thinking

As was the case with earlier iterations of the National Curriculum, some teachers tend to have a sceptical view of these, viewing them as 'bolt-on' accessories to the main business of subject teaching. But let us take time to consider the implications of cross-curricular dimensions on subject teaching. The QCDA (then QCA) said this of the dimensions:

The cross-curriculum dimensions reflect some of the major ideas and challenges that face individuals and society, and help make learning real and relevant.

The dimensions are unifying areas of learning that span the curriculum and help young people make sense of the world. They are not curriculum subjects, but are crucial aspects of learning that should permeate the curriculum and the life of a school.

(QCA 2009: 1)

This raises all sorts of issues! The dimensions contain major ideas, but are non-statutory, they help 'young people make sense of the world', but they lie outside subjects. But once we get past the scepticism we can see that these are things which we would want our learners to be. Let us try to unpick some of the details, as a precursor to our more detailed thinking in later chapters.

As an example, let us take the issue of identity and cultural diversity. This dimension, the QCDA says, will help young people:

- develop their own sense of belonging and self-esteem
- recognise the value of diversity within and between identities, groups and communities
- understand the multiple and shared identities, beliefs, cultures, traditions and histories of the people in the UK, and recognise that these have shaped and continue to shape life here
- understand the importance of human rights and the consequences of intolerance and discrimination, and know how to challenge these
- understand the need for everyone living in a democracy to participate in decision-making

- understand the factors that influence and change places, communities and wider society, such as migrations, economic inequality and conflicts
- recognise the UK's changing relationship and interconnections with the rest of the world
- critically reflect on the shared and diverse values in society

(QCA 2009: 11)

Some of these seem like big topics, and far broader than a single curriculum area can deal with. Yet the arts are in many ways the ideal place for some of these big questions to find a home. Let us take the first bullet as a case in point. Issues of self-esteem are important in our young people.

The self, and identity

Feeling a sense of self-worth and confidence can be fostered and engendered through collaborative work in the arts, almost unlike any other subject area. Here is a teacher talking about cross curricular project work with Year 7 pupils:

... we don't really have any sort of set testing or anything like that so, in terms of facts and figures it might be difficult to assess pupils' attainment, but certainly we've noticed in lessons that the pupils are gaining in confidence, and the pupils are used to working together in groups. Working in pairs, in small groups, and as a large group, as a whole class. And we find that their confidence is improving and they're quite willing to speak out and share their opinions whereas before, with, you know with previous experience of year sevens they seem to be, you know they seem to be quite shy and perhaps unwilling to voice an opinion in case, you know in case they feel silly about it or if anyone makes a comment about it

(KS3 teacher)

These are powerful sentiments, but then these can be life-changing experiences for the young people!

There are a number of ways in which the issue of self-esteem can be considered in educational terms. One of the most well-known early pieces of work in this domain is that of Maslow, who proposed a hierarchy of needs (Maslow 1954), ranging from basic physiological needs, for example food, drink and air, through to self-actualisation, and reaching one's full potential. In the middle of this hierarchy Maslow placed the need for self-esteem. In fact Maslow divided this into two, *competence*, which he saw as being the need to be confident in front of peers, and the second being *recognition*, which he viewed as the desire to be respected by others. If these needs are not met then feelings of anxiety and inadequacy can result. For students in schools this can manifest itself in the ways pupils think about themselves, and express thoughts about themselves, or, in some cases, fear of expressing themselves for fear of ridicule.

Low self-esteem means a negative sense of self. It may be openly expressed ('I'm useless', 'I don't matter', 'I'm a failure'), or it may be an underlying sense of inadequacy or worthlessness that is hard to put into words. Low self-esteem is neither an ...

emotional disorder nor a personality disorder ... but rather an element of many different presenting problems.

(Fennell and Jenkins 2004: 413)

For many teachers, working to enhance student self-esteem is an important aspect of the work they do. For students with low self-esteem, tasks which allow them to succeed are often seen to be important in engaging them with the learning process. Some students with low self-esteem would in some cases prefer to give up on tasks early on, rather than fear failing at them. For this reason constructing learning encounters which allow children to 'fail safely' is often a key component in the design of cross-curricular learning encounters.

Related to the notion of self-esteem is that of self-efficacy. Self-efficacy was described by Bandura as

... people's judgements of their capabilities to organize and execute courses of action required to attain designated types of performances. It is concerned not with the skills one has but with the judgements of what one can do with whatever skills one possesses.

(Bandura 1986: 391)

This makes an important distinction from self-esteem, as here the concern is with how the individual feels about their ability to perform in various areas. This affects motivation too: 'Efficacy beliefs influence how people feel, think, motivate themselves, and behave' (Bandura 1993: 118). From the perspective of thinking about cross-curricular learning, it is appropriate to consider learning activities which help students develop their feelings of self-efficacy as potentially helpful. This is not only intrinsically worthwhile, but as Zimmerman notes:

... self-efficacious students participate more readily, work harder, persist longer, and have fewer adverse emotional reactions when they encounter difficulties than do those who doubt their capabilities.

(Zimmerman 2000: 86)

Considering the self-efficacy of students is an appropriate backdrop to a consideration of cross-curricular learning encounters which develop supportive and cooperative ways for pupils to learn together.

Teacher identity

In addition to considering the fostering of self-esteem and self-efficacy in students, it will also be the case that some of the material in this book might challenge the conceptions you hold of your own identity as a teacher. The first reflective task in this chapter asked you, in essence, to label yourself. This produced a labelled identity of yourself as 'Head of Maths', or whatever. But some of you will have said 'teacher of children', or something

similar. This is a different identity, and shows you think of yourself in this light. So, what is a teacher identity?

Teacher professional identity then stands at the core of the teaching profession. It provides a framework for teachers to construct their own ideas of ‘how to be’, ‘how to act’ and ‘how to understand’ their work and their place in society. Importantly, teacher identity is not something that is fixed nor is it imposed; rather it is negotiated through experience and the sense that is made of that experience.

(Sachs 2005: 15)

The point to note here is Sachs’s observation that ‘teacher identity is not something that is fixed nor is it imposed’, this means the identity you hold as a teacher is subject to change. You will have different insights, different views on education, and different feelings about how things work over time, both as a result of the accumulation of experience, and of changing views. The way in which you function as a teacher, and the identities you have constructed for yourself might be challenged, possibly threatened, or affirmed by some of the ideas which you come across over time. This point too needs to be borne in mind as we work our way through the some of the ideas and discussions in this book. We shall revisit the notion of teacher identities in Chapter 3.

Organising learning

So far we have been considering the sorts of themes that can be incorporated into cross-curricular teaching and learning. What it is useful to do at this point is to ask four key questions:

- What is it we want pupils to learn?
- How do we want them to learn it?
- What is the best way of making this happen?
- How will you know?

Reflective task

Have you ever stopped and asked yourself these questions?

Do it now. Try to think big, beyond your subject too!

So, what is it we want students to know, and therefore what do we want them to learn? This is a really hard question to answer properly. A simple response is to think about what is required by the National Curriculum, and say ‘in my subject they need to know about X, Y and Z’. Is that sufficient? Is what we want pupils to learn solely the topics of the National Curriculum? So we only want them to know about Shakespeare, quadratic equations, volcanoes, Nazis, dissection, mixing colours, and a few other bits too? This seems a very reductive way of dealing with the complex and multifarious issues of world

culture. Another approach to this question is to follow a line of reasoning that rethinks 'what is it we want pupils to learn?' and asks 'what sort of people do we want our school leavers to be?'; or, maybe 'what does it mean to be an educated person in the twenty-first century?'. These are all much harder questions! It is entirely likely that the sorts of lists that will result from deliberations in answer to these questions are likely to look very much like the sub-components of the QCDA's cross-curricular dimensions. We want caring, confident, secure individuals, mindful of, and compassionate to, the needs of others, aware of global issues, able to take responsibility, be upstanding citizens, and so on. Knowing about volcanoes (etc.) might help, but there are other issues which are important too, including the strands in individual National Curriculum subjects that refer to cross-curricular teaching and learning.

How do we want them to learn it?

A Victorian era public school headmaster would probably not have felt out of place looking at many secondary school timetables in the closing years of the twentieth century. Learning appeared to be organised into discrete blocks, and allocated time according to its perceived importance. This fairly static model has been broken down in the early years of the twenty-first century in many schools. For example, some schools suspend the timetable on certain days, others have thematic weeks, some merge blocks of subjects into groups, one school has 'funky Fridays' where cross-curricular projects are undertaken, and a few suspend the timetable altogether for new Year 7s, and organise them in a more primary school way to facilitate transfer. The new National Curriculum encourages this, and more and more schools are trying these new ways.

One of the driving forces behind these changes is the notion that learning and knowledge are not itemised, and then categorised into boxes with fixed boundaries. There are topics that cross over a range of subjects. As an example of this thinking, let us take a relatively straightforward construct, that of measuring. There are numerous ways in which measuring occurs in subjects:

- measuring the width of the margin to draw in an exercise book
- measuring distances on maps
- measuring how far a javelin has been thrown
- calculating how near the Sun is
- weighing of ingredients in food technology
- weighing out tiny quantities of chemicals
- measuring the time it takes to run 100 metres in PE
- thinking about geological time
- counting beats in music
- ...and many, many other examples

Measuring is clearly a cross-curricular skill. But who should teach it? Do all the teachers of the subjects involved in the list assume someone else has? Or do they all assume no one has, and teach it again from scratch? Either of these two responses seems wrong,

pupils will either be left to work it out for themselves, or waste time repeating things they already know and can do. Certainly there will be subject specific aspects of measuring, ranging from getting out of the way of moving javelins, to using the right tools for weighing tiny amounts of chemicals, but even so, the principle remains. What this discussion is moving towards is the notion of a *curriculum map*. We saw at the beginning of this chapter that the original National Curriculum was drawn up by the separate subject groups in isolation from each other. In many ways that isolationism has remained, and the current National Curriculum, although much more fluid in its subject boundaries, has retained something of the exclusivity of subject delineation of the previous ones. But what is curriculum mapping?

Mapping the curriculum

Working out what bits of knowledge are taught and learned where, when, and by whom, are not as yet common in UK schools. At its simplest, making a map of the curriculum involves heads of departments listing topics taught in units of work, and then taking an overview as to how these fit with other departments, and other units of work across the school. Undertaking this exercise is time-consuming, probably best done using ICT, and requires dedicated time and resources. But, having been done, what is shown can be quite revealing! As Janet Hale notes, ‘curriculum mapping is a multifaceted, ongoing process designed to improve student learning’ (Hale 2007: 4). If schools find that some topics are being taught on a number of occasions, and others not at all, then this in itself is a useful outcome.

This kind of curriculum planning is encouraged by the National Curriculum. A closer look at individual subject’s programmes of study reveal important new emphases on collaborative, cross-subject working. In every subject’s ‘Wider Opportunities’ statements you will find references like:

- Work on problems that arise in other subjects and in contexts beyond the school (Mathematics 4d);
- Develop speaking and listening skills through work that makes cross-curricular links with other subjects (English 4f);
- Make links between science and other subjects and areas of the curriculum (Science 4k); and
- Make links between geography and other subjects, including citizenship and ICT, and areas of the curriculum including sustainability and global dimension (Geography 4i).

These subject references to cross-curricular opportunities are particularly helpful and represent a significant shift in the curriculum orders. They are, of course, statutory and a plethora of advice about how to implement these (and other) changes has been produced for teachers (QCDA 2009).

Alongside the cross-curricular dimensions and the individual subjects’ Programmes of Study, there are other statutory elements of the curriculum at Key Stage 3 that all teachers have to embed within their teaching. These include Functional Skills in English, mathematics and ICT, and the Personal, Learning and Thinking Skills (PLTS). Both these sets of skills and competencies will require teachers to make imaginative links

between their subject's knowledge, skills and understanding and other areas of knowledge. This has many similarities to what we might consider a more traditional cross-curricular set of teaching and learning approaches.

So, every teacher in every subject at Key Stage 3 is charged with developing a cross-curricular approach to teaching and learning. It is the law.

Case Study: Curriculum Mapping: Topic – Slavery

In one school a chance conversation between the music and history teachers in the staffroom led to them undertaking a single-topic curriculum mapping exercise with regards to the topic of slavery. The music teacher was doing a unit on the origins of the blues with Year 9 pupils, and included a section on the origins of the blues in the work songs of slaves. The history teacher had taught the topic of slavery as a component of Year 8 work. Inquiring across the staff on a wider basis they found that the topic was also taught, or at least touched upon, by a range of subjects, including:

RE: where the moral implications and political implications were discussed, alongside a study of the Moses and the Hebrew slaves in the Old Testament.

Citizenship: Where the effects of post-colonial immigration and pupil identities were discussed.

Geography: Where studies of human geography included a section on the transplantation and forced migration of peoples.

English: where pupils were working on empathetic stories and poems of what it was like to be a slave.

Art: where aspects of slavery as a source of inspiration were investigated.

From a chance conversation a whole area of study was shown to pervade the curriculum!

The example of the slavery topic shown above is but one readily apparent thematic area which figures across a range of subjects. This information would not have been apparent without the teachers concerned seeking it out.

According to Andrew Porter, writing from an American context, there are four ways of looking at the curriculum:

Curriculum can be divided into the intended, enacted, assessed, and learned curricula. For K-12 education, the intended curriculum is captured most explicitly in state content standards—statements of what every student must know and be able to do by some specified point in time. The enacted curriculum refers to instruction (e.g. what happens in classrooms). The assessed curriculum refers to student achievement tests.

(Porter 2006: 141)

These four categorisations are helpful in thinking about the way learning is organised, and the ways in which it actually takes place. The learned curriculum is everything that pupils learn in schools, including everything from when not to run in corridors, to how to go in to assembly. This links to the notion of *the hidden curriculum*, so called because it is not overt, but contains all the incidental things pupils learn at school. There are many other ways of thinking about curriculum. Lave and Wenger (1991) discuss the differences between a *teaching curriculum*, and a *learning curriculum*. In the former, teaching is the main focus of activity, whereas in the latter the main focus is on learning. Hale (2007) distinguishes between the *planned* and the *operational* curriculum. The planned curriculum involves the documentary preparation, units of work, and lesson planning materials produced by teachers, the operational curriculum is what actually comes out from this planning, in the sense that not everything that is planned for pupils to learn actually takes place. This seems to be an issue for schools, especially when the only people who have a knowledge of the full extent of the curriculum map are the pupils, rather than the teachers and school leadership teams!

It should be clear from these discussions that one of the major issues facing cross-curricular thinking is in working out what the existing planned curriculum is in the first place!

Breaking Barriers: The role of the 14-19 Diplomas

It will be no easy feat to establish a curriculum map, but one way which some schools have addressed this issue is to approach the task from a different angle, and plan afresh for extended learning experiences. An example of this is to be found in the UK in the diploma qualification for 14-19 year old students. At the time of writing there are 14 diplomas available, covering the following areas:

- Business, Administration and Finance
- Construction and the Built Environment
- Creative and Media
- Engineering
- Environmental and Land-Based Studies
- Hair and Beauty Studies
- Hospitality
- Information Technology
- Manufacturing and Product Design
- Public Services
- Retail Business
- Society, Health and Development
- Sport and Active Leisure
- Travel and Tourism

As an example of these, let us take the Creative and Media diploma, and think about it from a cross-curricular perspective. To do this, we shall focus on the foundation level qualification. Teaching for the diploma is organised thematically, rather than in a

subject-content driven fashion. Indeed, there is an exhortation to teachers to think outside of and beyond traditional subject boundaries

Teaching of the key themes should reflect the aim of the creative and media Diploma by integrating key themes across the disciplines, rather than taking a 'single-subject' approach.

(QCA n.d.: 7)

The themes concerned are:

- Creativity in context
- Thinking and working creatively
- Principles, processes and practice
- Creative businesses and enterprise

Work on these will encompass studying aspects of :

- art and design: 2D and 3D art, craft, graphic design, product design, fashion and textiles, photo imaging
- performing arts: dance, drama and music
- media: film and television, radio and audio, interactive media, animation, computer games, creative writing, advertising

(QCA n.d.: 14)

There is an expectation that much of this work is practically based, allowing schools to tailor the provision to suit their own particular needs and requirements, meaning that the specific details of diploma provision will be available to individual schools to develop, working alongside industry partners.

What this brief discussion concerning the diploma has shown is an alternative approach to curriculum mapping. Here the content is decidedly multi-subject and cross-curricular, and so planning takes place from a different starting point, in this case the thematic approaches outlined in the diploma regulations.

Personalising cross-curricular learning

Personalising learning is about making learning relevant for the pupils in schools across the country. It is about personalising that which is learnt for the specific local requirements and needs, and for the abilities and interests of each class. It does not necessarily mean having thirty pupils working on different things at the same time! Here is one influential definition of personalised learning:

Learner-centred and knowledge-centred

Close attention is paid to learners' knowledge, skills, understanding and attitudes. Learning is connected to what they already know (including from outside the

classroom). Teaching enthuses pupils and engages their interest in learning: it identifies, explores and corrects misconceptions. Learners are active and curious: they create their own hypotheses, ask their own questions, coach one another, set goals for themselves, monitor their progress and experiment with ideas for taking risks, knowing that mistakes and ‘being stuck’ are part of learning. Work is sufficiently varied and challenging to maintain their engagement but not so difficult as to discourage them. This engagement allows learners of all abilities to succeed, and it avoids the disaffection and attention-seeking that give rise to problems with behaviour.

(Gilbert and Teaching and Learning in 2020 Review Group 2006: 6)

The 2020 report also observes that ‘... Pupils are more likely to be engaged with the curriculum they are offered if they believe it is relevant’ (Gilbert and Teaching and Learning in 2020 Review Group 2006: 20). Personalising learning can also be considered as *relevantising*, making learning relevant to the pupils. This means that different approaches and topic areas may be appropriate for learners in the inner cities, whilst different ones may be appropriate for those in the suburbs, and different ones again for those in rural areas. So, what does this mean for cross-curricular learning?

Reflective task

What are the specific locational characteristics of the pupils at your school? Is it urban, rural, affluent, mixed, or what?

How have you adapted what you teach to be suitable for your pupils?

If you can consider a school to be the opposite of some of the characteristics you have described above, how different might you have to make the curriculum?

This is personalising the curriculum, how is it encouraged at your school?

Historically, teachers have often worked out how to teach a specific and predetermined number of units of work, and stick with them. We occasionally hear stories of teachers still teaching units with the old school name on the folder from where they used to teach some years into a new post! This is personalising *teaching*, in the sense that it ‘belongs’ to that teacher. It is not personalising *learning*, by matching what is being done to the needs of the pupils in that particular school.

Vignette

In Birmingham there is a street with two secondary schools directly facing each other on opposite sides of the road. They are very different schools. Each has its own strengths and priorities. Although so close, units of work are very different in the two schools, and teaching and learning are very different too. Personalising learning means that differences are obvious to anyone visiting.

Assessment

One of the key themes which we shall return to on a number of occasions is that of assessment. In Chapter 6 we discuss this in some detail, but here it is appropriate to note that assessment needs to be considered alongside curriculum design and innovation. This is particularly the case with summative assessment, particularly high-stakes summative assessments which have been externally designated, as the teaching and learning will need to be validated by these. Thus in the case of diplomas the requirements of the awarding bodies will be of primary concern. A less clear-cut relationship occurs at KS3, where National Curriculum assessment is to be carried out in single subject modalities.

Personalising, planning, and assessment

When preparing for personalising learning, and thinking about how best to organise the planned curriculum, the examples we have been discussing provide us with two common models of how this is normally undertaken. In the first model, the curriculum is planned, and the summative assessments which will take place are organised to follow the intended learning. Formative assessment, which, as we shall discuss later, is likely to make a real difference to learning, will be happening throughout the learning process. In the second model, curriculum organisation begins with a consideration of the final summative assessment, and the planned curriculum is then organised so as to deliver learning based on the requirements of the assessment. A diagrammatic representation of this is given in Figure 1.1, which shows the process from the perspective of planning, not delivery.

Neither of these ways is automatically better, but teachers need to be clear in their own minds which of the two models is in operation when they are planning for teaching and learning to take place. We know that assessment is a matter of concern for many teachers, and so being clear about how the work being undertaken is to be organised should help bring a degree of clarity to an already complex situation.

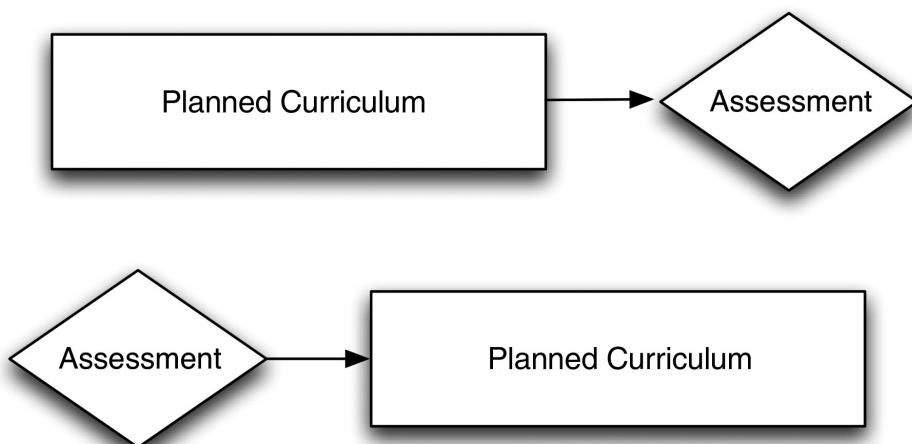


Figure 1.1 Planning and assessment.

Creativity

All of these discussions concerning curriculum mapping, assessment and planning may seem a long way from the excitement that good cross-curricular learning entails, and so let us return to one of the core topics of cross-curricularity in the arts, that of creativity. Creativity and critical thinking figure as one of the cross-curricular dimensions of the National Curriculum. We shall consider creativity and critical thinking separately, beginning with the former.

Reflective task

What is creativity? Do you have a definition you can use? How does it apply in your teaching?

Defining creativity is notoriously complex, and we consider this in some detail in Chapter 2, so to short-circuit this for our present considerations, we shall use the definition of creative processes provided in the National Advisory Committee on Creative and Cultural Education report *All Our Futures*:

First, they always involve thinking or behaving imaginatively. Second, overall this imaginative activity is purposeful: that is, it is directed to achieving an objective. Third, these processes must generate something original. Fourth, the outcome must be of value in relation to the objective.

(NACCCE 1999: 30)

Creativity, therefore, involves these four processes. What do they mean? Let us consider them each in turn.

Imaginative activity

Imaginative activity occurs when students engage in processes which are generative in nature, they are creating new ideas, seeing things from a different angle, or forming previously unknown connections. This is from the perspective of the individual making the new connections, generating new ideas, or thinking of new associations. It is important here to note that this does not mean that the ideas in question have never been thought of before by anyone, but rather that the new ideas in question are new for that individual. Margaret Boden draws the distinction between creative acts which are new and original for the student in question, and those which are entirely new for anyone. The former she calls *psychologically creative*, abbreviated to P-creative; these are creative ideas which have occurred to an individual, but which the teacher or others may well have encountered before. The latter she calls *historically creative*, or H-creative; these are ideas which are both novel for the individual, and novel in the historical sense that no-one has had them before.

If Mary Smith has an idea which she could not have had before, her idea is P-creative – no matter how many people have had the same idea already. The historical sense applies to ideas that are fundamentally novel with respect to the whole of human

history. Mary Smith's surprising idea is H-creative if no one has ever had the idea before her.

(Boden 1990: 32)

These are important distinctions for us, as we are able to use them to account for work which the students undertake and produce which is new and novel for them, but which may not be original when viewed from a wider perspective. This allows us to celebrate acts and process of P-creativity as being worthwhile within the contexts in which they are created. This point takes us to the second of the NACCCE definitions.

Imaginative activity is purposeful

To undertake generative thought is not simply to daydream! Creativity needs to be applied to a purpose, and should result in an outcome. We know that creativity involves risk-taking, and not all creative endeavours will be earth-shattering but, nonetheless, they are original and creative for the student involved, and can be treated accordingly. Purposeful activity means there is some point to what is going on, and this can take a variety of forms.

Generate something original

It follows from our discussions of the work of Margaret Boden that originality is to be found in P-creative acts that students undertake. This means that originality can be thought of as being relative, rather than absolute. The implications of this for the teacher are that original work can be original for the students concerned, but maybe not original compared with what others have done. This does not mean that the students should feel in any way diminished by taking routes which others have taken before them, but that their creativity should be celebrated. It involves non-linear thinking to solve problems, and this can be found in many curriculum areas.

Outcome of Value

The NACCCE report has this to say about generating creative outcomes which are of value:

We described imaginative activity as a generative mode of thought; creativity involves a second and reciprocal mode of thought: an evaluative mode. Originality at some level is essential in all creative work, but it is never enough. Original ideas may be irrelevant to the purpose in hand. They may be bizarre, or faulty. The outcome of imaginative activity can only be called creative if it is of value in relation to the task at hand. 'Value' here is a judgement of some property of the outcome related to the purpose. There are many possible judgements according to the area of activity: effective, useful, enjoyable, satisfying, valid, tenable. The criteria of value vary according to the field of activity in question.

(NACCCE 1999: 33)

This is an important part of the creative process, it is about knowing whether the object provided fits the requirements. After all, if in a music lesson a creative response is

required, perhaps in the form of a song, then the students need to know that it would not be appropriate to design and make a table! The outcome needs to bear some relation to the objectives of the task set.

Creativity in schools

Creativity is valued in society generally:

Creativity is good for the economy and therefore for society. It is good for individuals who are more fulfilled when creative and who do not need to be Einstein to manifest creativity.

(Craft 2003: 115)

In the National Curriculum creativity is also felt to be important:

Creative activity is essential for the future wellbeing of society and the economy. It can unlock the potential of individuals and communities to solve personal, local and global problems. Creativity is possible in every area of human activity – from the cutting edge of human endeavour to ordinary aspects of our daily life.

(QCA Curriculum Dimensions website n.d.)

Creativity appears in the value statements of many National Curriculum subjects, not just the ones where you might expect it. Here are some examples:

Maths:

Mathematics is a creative discipline.

Science:

The study of science fires pupils' curiosity about phenomena in the world around them and offers opportunities to find explanations. It engages learners at many levels, linking direct practical experience with scientific ideas. Experimentation and modelling are used to develop and evaluate explanations, encouraging critical and creative thought.

History:

History fires pupils' curiosity and imagination, moving and inspiring them with the dilemmas, choices and beliefs of people in the past.

Modern Foreign Languages:

Learning languages gives pupils opportunities to develop their listening, speaking, reading and writing skills and to express themselves with increasing confidence, independence and creativity.

All of these subjects feel creativity is important enough to warrant inclusion, and yet none might be considered to be ones which have an axiomatic association with creative processes.

Critical Thinking and Personal Learning and Thinking Skills

Thinking skills figure significantly in two National Curriculum domains. These are the cross-curricular dimensions, described above, and that of personal learning and thinking skills (PLTS). The similarities are such that it is worth considering them together for our discussions of cross-curricular learning.

In the case of the PLTS, the framework consists of six groups:

- independent inquirers
- creative thinkers
- reflective learners
- team workers
- self-managers
- effective participants

These are important areas of concern, and will be addressed as we look in more detail at specific aspects of cross-curricular learning.

Reflective task

Developing thinking might be thought of as being something that teachers will want to do automatically with their students. But what does it mean to want to have students who are independent inquirers, or reflective learners?

Are these skills?

If so, do you teach them?

Or do you expect students to somehow acquire them otherwise?

What does thinking mean anyway?

... and how do you teach it?

These are complex questions indeed! The way we shall set about addressing them is to consider what a taught curriculum for thinking might look like, and then use this as a way of considering how we can develop these ideas.

There is a probably apocryphal story about a lost motorist stopping in a strange town and asking a local inhabitant directions to nearby village, 'If I were going there, I wouldn't start from here' being the somewhat bewildering reply that they received! This is rather like the task we are engaged upon here. Instead of asking how we can teach thinking in schools, bearing in mind where we are now, how would it be if we were somewhere else, with a blank sheet of paper, and starting afresh? How would we foster teaching and learning for thinking?

Practical task

Have a go at answering this yourself. Think of two things you might do to developing thinking skills in students, without the constraints of your current situation.

Many answers teachers provide to this tend to involve two things:

- Active learning
- Problem solving

Maybe yours did too? Many see active learning as being key to developing thinking skills amongst our learners. Indeed, as brain-based research becomes more developed we are finding out that active learning is most likely to be the primary way we find out about, and engage with the world around us:

The brain grows and increases, and intelligence increases, through being used. Strengthening brainpower, which is physiologically rooted in stimulating and reinforcing the synapses, strengthens learning. The brain loves to learn. Further, the brain is not a passive store of information; it thrives on activity, and actively seeks out information from the environment in order to learn – that is, it is proactive. There are more neural connections from the brain to the ear than from the ear to the brain, and some 10 per cent of the fibres in the optic nerve go ‘the wrong way’. The brain, through sense organs, does not passively receive information, it deliberately goes fishing for it.

(Cohen *et al.* 2004: 173)

Problem solving is often how active learning can be enacted. This can range from divergent thinking tasks, like demonstrating five different uses for a pebble; via the practical, such as how can we make better use of, or cut down on, waste paper in school, or how can we cut down on our carbon footprint at school; to specific, such as how can we use a set of specific materials to cross the school hall without touching the floor. These are useful activities to undertake, and go some way towards addressing concerns that education can be too involved in learning and recall,

Creative problem solving is needed to make up for the shortcomings in our basic education where there has been an emphasis on the use of our mind for storing information instead of developing its power for producing new ideas and turning these into reality. Our productivity will be enhanced when we use our brain to question, explore, invent, discover and create – in other words, employ creative thinking. Through creative problem solving, we generate new ideas and innovative solutions for a given need or problem. These ideas will be more efficient and often of much higher quality. Creative problem solving gives balance to our thinking since it integrates analytical and imaginative thinking. Intuitive and interpersonal thinking are

as important as critical and structured thinking for achieving the best results. Thus, creative thinking skills are needed to help people accept and cope with change.

(Proctor 2005: 18)

Cross-curricular learning is needed for these to flourish. As the curriculum mapping discussion above revealed, a lot of single subject learning is focused on the assessment-driven model, whereby high-stakes summative assessment at the end point of a course drives the content to a considerable extent.

Summary

This chapter has introduced a number of ideas. It began by asking questions of knowledge, and what our understandings of curriculum entail. We have considered how the National Curriculum in the UK originally came into being as a series of separate subject areas. We then moved to a consideration of pedagogy, and of the important notion that teaching is not a one-to-one mapping onto learning. The cross-curricular dimensions of the National Curriculum have been discussed, and their importance as topics which exist outside, yet across subjects, was considered.

One of the key focuses for discussion has been the idea of a curriculum map, and establishing the range and scope of learning which is already taking place in schools, yet very often without all the threads being drawn together in a formal and logical fashion. Lave and Wenger's (1991) notion of the teaching curriculum being separate from learning curriculum was also discussed here. The nature of the cross-curricular learning which is planned for in the 14-19 diplomas was discussed, as was the thematic areas which are employed there. The linked notions of curriculum and assessment were introduced with key distinctions being drawn between two models of planning, curriculum led, and assessment led.

The key area of creativity, which will be a major informant to many aspects of this book was explored. The significant work of Boden (1990), where acts of P-creativity which allow the creative utterances of all pupils to be considered as being valid was outlined. PLTS and thinking skills were examined, and the role which they can play in cross-curricular learning introduced. Finally, we examined notions of identity and self, both from the perspectives of the students, and of the teacher.

Professional Standards

Part of the process of reflection which this book champions is that of making oneself accountable to processes of professional development. For those readers undertaking initial teacher education, this would include reflecting on the Q Standards regularly and building your evidence base that demonstrates your effective meeting of them. For those readers already working as teachers, there will be strategies of performance appraisal and review, which often involve these same standards, and require you to set targets and monitor your process through reflective cycles.

To assist with these processes, each chapter in this book, and the accompanying titles within the series, has considered how the text and activities within it have helped the

reader meet the Q Standards for ITT, and the C Standards for those already in service. A summary of the application of these standards to the chapter follows. We trust that you will find this a helpful way of applying your work in reading the chapters (and your completion of any of the activities within them) to your wider professional development.

Meeting the Standards

This chapter will help you meet the following Q standards:

Q6, Q7, Q8, Q14, Q18

Professional Standards for Teachers

This chapter will help you meet the following core standards:

C6, C7, C8, C10, C15

Notes:

- 1 Thanks to Simon Spencer of Birmingham City University for this.

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