

# Progression in Geographical Understanding

*Trevor Bennetts*

The concept of progression is applicable to how students' geographical understanding can advance over a period of time, and how courses can be designed to facilitate such advances. Understanding is a product of experience, ideas and mental processes, and the interrelationships between them. The ideas which are most characteristic of geographical understanding are those associated with its distinctive perspectives of place, space and environment. However, geographical understanding also makes use of ideas which have been developed in other disciplines, and important ideas which are common to most disciplines. Planning for progression should take account of practical and theoretical considerations. Progression involves a wide range of different qualities/dimensions which are illustrated here in relation to the theme of weather and climate.

**Keywords:** progression, understanding, curriculum, levels of performance, dimensions of progression

The proposition that curricula should be designed to support progress in learning is one of the most widely accepted tenets of educational thinking. However, there is somewhat less agreement about what constitutes progression, and how best to bring it about. The same is true for the notion of understanding, which is a fundamental aim of most curriculum subjects. Both concepts are difficult to define in precise terms, and their meaning often appears to be taken for granted, with the result that little attention is given to consequent implications for curriculum planning and teaching. While this paper explores the nature of progression in geographical understanding, in the context of the curriculum for the secondary phase of education in England and Wales (i.e. for students aged 11–18), I hope that the ideas included will be relevant to other educational systems where the curricular provision for geography has sufficient continuity to support students' progression in learning. Attention will be given to:

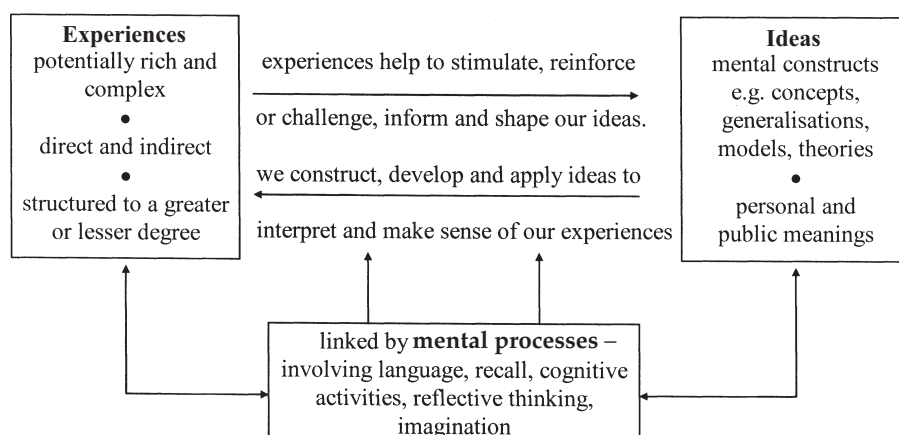
- what we mean by *progression* and *understanding*;
- the particular nature of *geographical understanding*;
- the significance, for progression in geographical understanding, of *practical considerations* arising from the curricular frameworks within which geography is taught;
- the relevance to the geography curriculum of some of the *theoretical ideas* which are pertinent to progression in learning; and
- application of the idea of *dimensions of progression* to the analysis of a recurrent content theme.

### **The Nature of Progression**

Progression focuses on intended or actual advances in students' learning, over a period of time. It is a fundamental idea for the whole enterprise of education, having implications for key elements in curriculum planning and practice: the specification of learning targets; the selection of content and activities; the design of learning materials; the interaction between teachers and students; the assessment and reporting of students' learning; and the evaluation and revision of teaching programmes and strategies. While the idea of progression is especially applicable to students' learning, most notably in relation to the qualities which are associated with advances in attainment or performance, it can also be applied to the design of courses and course materials which are intended to bring about these changes. Much of the treatment of progression in the educational literature is about how best to structure courses to enable students to advance their learning in an orderly way. It is useful to distinguish between the ideas of 'sequence' and 'progression'. Sequence, in the context of the curriculum, is essentially about the order in which content and activities are introduced and organised. While a sequence of some sort is inevitable within any curriculum, progression in learning is not an inevitable outcome. Progression focuses attention on the quality of students' learning, and how that can be developed over periods of their education. Although it can be applied to different time scales, the idea becomes especially pertinent when applied to long periods, during which students' cognitive abilities, depth of understanding, and development of value systems are affected by maturation processes, as well as by experience. In secondary education in England and Wales, geography is a compulsory subject for almost all students over the first three years, and the period of study is extended to five years for those who select the subject for the General Certificate of Education (GCSE), to six years for those who continue to an Advanced Subsidiary (AS) course, and to seven years for those who complete a full two year A Level course. The idea of progression is highly relevant to the planning and teaching of curricular programmes over such time scales.

### **The Nature of Understanding**

Understanding is, arguably, the most important of the cognitive goals of education. One reason why it is difficult to define understanding, in a clear and precise way, is because the idea is applied to such a wide range of phenomena: to objects, patterns and processes; to events and to situations; to issues; to individuals, communities and cultures; to particular ideas and to bodies of knowledge. Not surprisingly, we can mean different things when we apply the word to different targets (Peel, 1972; White & Gunstone, 1992). An additional reason is its complex and subtle relationships with other important cognitive goals, such as knowledge, intellectual skills, and values. At the core of the concept of understanding is the notion of 'making sense' of something, or 'giving meaning' to something. This usually involves making connections, and comprehending relationships; and invariably implies going beyond what is directly accessible to our senses or beyond the information which has been given to us. Newton (2000: 24), emphasises the importance of connections to 'levels or degrees of understanding', commenting that 'what one student



**Figure 1** The roots of understanding

constructs (consciously or unconsciously) may have few connections and relate poorly to existing experience or knowledge', while 'another student may construct detailed, numerous and complex connections, integrated extensively with prior knowledge and encompassing other levels of understanding'.

Figure 1 suggests that understanding can be envisaged as a product of experience, ideas and mental processes, and of the interrelationships between them.

Our **experiences** vary considerably, depending, for example, on where we live, the social conditions in which we operate and our personal circumstances. We accumulate a rich stock of experiences depending on the personal, social and environmental context of our lives. The term 'experience' is being used here in a broad sense, to include information derived from indirect sources, as well as from direct experiences associated with the events, situations and conditions which we observe, and the activities in which we participate. Geographical education can draw extensively on both types, with classroom activities characteristically making much use of a wide range of indirect sources, such as texts, maps, photographs and diagrams, while fieldwork activities provide opportunities for more direct forms of experience. However, students bring to their lessons memories, knowledge, assumptions and beliefs, based on experiences outside of formal education, which can also influence strongly the development of their understanding. In recent years, the opportunities for both direct and indirect geographical experiences have been extended greatly: in the case of the former, by the growth in opportunities to visit distant places; and in the case of the latter, by developments in ways of communicating information. While experiences can be very personal, not least because of the ways in which we relate them to previous experiences and to existing interests, knowledge and beliefs; many experiences are shared, as a consequence of observing similar events, participating in similar activities, exposure to similar information, and discussion. Formal education provides a very significant part of students' shared geographical experience. At the same time, teachers can encourage and help students to 'draw on their own experiences in order to learn about geography' (Bradford, 2000: 319).

Our **ideas** help us to make sense of our experiences. Such ideas include concepts, generalisations, models and theories. Concepts are the basic building blocks of our conceptual structures, and are usually represented by nouns and verbs. While many of the concepts which we use in geography relate fairly closely to familiar features and experiences, other concepts, which have been constructed to provide deeper insights, involve a higher order of abstraction. Thus, ideas such as suburb, town centre and commuting can be contrasted with more abstract notions, such as accessibility, urban structure and spatial interaction. Generalisations specify relationships between concepts, and are characteristically expressed by propositional statements in the form of a principle or rule. To understand the structure of an idea in the form of a generalisation, it is necessary to know the meaning of the concepts which are included in the statement and the nature of the relationships between them. Concepts and generalisations can be combined to create more elaborate conceptual structures, variously described as constructs, models and theories. While, in practice, all three terms are used in various ways, they all embody the notion of coherent conceptual frameworks, composed of interrelated ideas, which help us to organise our thinking (Tanck, 1969). Therefore, they provide potentially valuable educational tools. As Figure 1 suggests, there is a two-way relationship between experiences and ideas, with our experiences helping to stimulate and shape our ideas; and our ideas influencing how we perceive reality, and how we interpret and make sense of experience.

Understanding is not something which we can acquire in a passive way. Learners engage actively in the development of their own understandings, through their use of a wide range of **mental processes**. Such active involvement is necessary, for example: to generalise from specific experiences; to formulate, develop and revise ideas; to make links and explore relationships; to apply ideas to the interpretation of experience; to develop appropriate language, in order to construct and articulate meanings; to develop sound methods of reasoning; to describe and explain effectively; to analyse and synthesise information; and to evaluate situations, evidence, judgements and behaviour. There has been much academic dispute over the claim by some educationalists that such complex activities can be developed as general skills (Barrow, 1999; Hart, 1978; Pithers & Soden, 2000; Smith, 1984; Smith, 2002). The official National Curriculum guidelines for secondary phase teachers in England (DfEE/QCA, 1999) encourage the development of students' 'thinking skills', which are conceived as including 'information-processing skills', 'reasoning skills', 'enquiry skills', 'creative skills', and 'evaluation skills'. Within the wider educational literature, authors refer to communicating skills, problem-solving skills, decision-making skills, social skills and even moral skills. The main reasons why critics are concerned about such broad applications of the word 'skill' are that: (1) it fails to do justice to the nature of complex cognitive processes, in particular, by apparently ignoring the relevance to thinking of knowledge, understanding, values, attitudes and beliefs; (2) it opens the door to the belief that thinking abilities developed in the context of one field of study can be transferred easily to other fields; and (3) the application of a general skills model to thinking processes can lead to inappropriate and inadequate teaching strategies. Such concerns serve to emphasise, rather than deny, the importance of the intricate interrelationships between mental processes and ideas.

The main elements and relationships highlighted in Figure 1 are all relevant to progression in understanding. Different experiences, ideas and thinking activities vary in the challenge which they present to learners. Students find it much easier to make sense of some experiences than of others. Even direct experiences can present difficulties when, for example: they are complex or confusing; contain distractions which inhibit the identification of significant structures and patterns; bear no obvious resemblance to previous experiences; or are so partial as to mislead. The difficulties for understanding associated with indirect sources, on the other hand, may also relate to: the form of communication used, and whether the student has developed the necessary competencies to 'read' the information which it contains; the clarity with which the information is presented; the selection of information and viewpoint of an author, which may colour an indirect source; and the suitability of a particular source for the age and ability of the students attempting to use it. Ideas similarly vary greatly in the challenges which they present, for they range from those in common use which can easily be exemplified by reference to familiar features and experiences, to those which have specialist and abstract meanings, far removed from direct experience. Many individual ideas are open to different levels of understanding, with higher levels often involving links to other ideas, within conceptual structures. Some ideas are demanding to grasp because they are intended to have a very precise meaning in particular circumstances – this is characteristic of many scientific concepts, while other ideas are fuzzy in meaning, and open to different interpretations. Some ideas attract dispute because they are value-laden. Clearly, there is a variety of qualities which influence the challenge which different ideas present to students. The same is true of the different thinking activities required of students to develop and apply understanding.

The development of the cognitive domain of 'Bloom's Taxonomy of Educational Objectives' illustrates both the difficulty of defining understanding, and the intricate relationships between understanding and cognitive skills. The original Taxonomy (Bloom *et al.*, 1956) was produced, in the USA, by a group of educational psychologists, who were concerned to clarify educational objectives in order to improve the quality of assessments. Working within a neo-behaviourist framework, they proposed categories which describe observable behaviours that are open to operational definitions, rather than use terms such as 'understanding' which are open to multiple interpretations (Bloom *et al.*, 1971). The six main categories of their cognitive domain – recall of knowledge, comprehension, application, analysis, synthesis and evaluation – were assumed to represent a cumulative hierarchy, within which 'mastery of each simpler category was pre-requisite to mastery of the next more complex one' (Krathwohl, 2002: 212–13). The higher levels are all taken up by intellectual competencies or skills, with understanding appearing to be most closely equated to 'comprehension', which is placed next to the lowest category. Although Bereiter (2002: 94–5) comments that 'a close reading of the monograph suggests that the authors viewed the whole taxonomy as addressing the issue of understanding', he nevertheless concludes that it failed to provide a satisfactory 'grounding for the notion of depth of understanding'. The recently revised version of the Taxonomy (Krathwohl *et al.*, 2002) does include 'understand' as a major category, but only as a replacement for 'comprehension'. This change in terminology appears to

have been a reluctant move, undertaken mainly because understanding is so commonly referred to by teachers when describing their objectives. More significant changes include the introduction of: (1) a 'knowledge dimension', in which distinctions are made between 'factual', 'conceptual', 'procedural' and 'metacognitive' knowledge; and (2) a 'Taxonomy Table', which is in the form of a grid, with the vertical axis based on the knowledge dimension, and the horizontal axis on the cognitive process dimension. While the table may encourage teachers and other educationalists to give fuller consideration to the relationships between conceptual knowledge and different types of cognitive activities and competencies, the narrow interpretation of understanding is unhelpful. The Taxonomy continues to emphasise general skills and capabilities, while underplaying the importance of the specific ideas associated with the understanding intended.

### **The Nature of Geographical Understanding**

While it is important for secondary school teachers to recognise the general attributes which characterise understanding, it is also important for them to be familiar with the more specific characteristics of the understanding associated with the academic discipline which underpins their curriculum subject. Each discipline has its own knowledge domain or territory, defined by the shared interests of its practitioners, the sort of questions which give direction to enquiry within that discipline, the ideas which they develop in response to those questions, and the methods of investigation and principles of procedure which they use. Although the priorities of an academic discipline should not determine the curricular content of a school subject, the main ideas and conceptual structures, developed within a discipline, are a rich potential source of understanding for secondary school students.

The academic territory of geography is not easily summarised in a brief, succinct statement. This is to a large extent due to the breadth of its methodologies, spanning the physical sciences, the social sciences and the humanities; the diversity of its content, as revealed by the range of its systematic branches and research topics; and its dynamic character. The history of the discipline during the second half of the 20th century was one of significant development and shifting emphases. Despite the scale and complexity of the changes, the discipline can be characterised in terms of a number of persistent perspectives which, to varying degrees in different periods, have directed the focus of its research and teaching. Geography is essentially the discipline which is concerned with the study of: physical and human environments and processes; relationships between people and environments; the character of places and landscapes; the significance of location and of spatial patterns, interactions and interrelationships on the Earth's surface; and the relevance of place, space and environments for human welfare. This approach, of describing geography in terms of a number of traditional perspectives, which was proposed by Pattison (1964), has been supported by other academic geographers seeking to provide an overview of the discipline (e.g. Allen & Massey, 1995; Broek, 1965; Haggett, 1965; Matthews & Herbert, 2004; McNee, 1967; Smith, 1977; Taaffe, 1974). It seems to me that it is not unreasonable to expect the geography curriculum in secondary education to

introduce students to the key ideas associated with the main perspectives of the discipline.

The major systematic branches of geography have strong conceptual links with particular academic disciplines. For example, major branches in physical geography are related to geology, meteorology, hydrology, ecology and pedology; while those in human geography are related to economics, sociology, political science, history, demography, urban studies and development studies. An important consequence is that content themes in the geography curriculum are likely to make use of ideas that are distinctively geographical (i.e. associated with the main geographical perspectives); ideas that have their origin in a related discipline; and very general ideas that are relevant to most disciplines. Some geography educationalists have given priority to the third type. For example, Leat (1998, 2000) suggests that the most important concepts in geography are: cause and effect, systems, classifications, location, planning, decision making, inequality, and development. Only one of the eight concepts – location – can in any real sense be regarded as distinctively geographical. Indeed, there does not appear to be any clear rationale for the selection. This list can be compared with that of the 'key concepts' proposed by the Schools Council History, Geography and Social Science 8–13 Project (Blyth *et al.*, 1976): communication, power (meaning social power), values and beliefs, conflict/consensus, similarity/difference, continuity/change, causes and consequences, which are similarly broad. The precise meanings and significance of such 'abstract vernacular concepts' (Marsden, 1976) depends on the context in which they are used. The planning of geography curricula would be served more directly, and probably more helpfully, by analyses of the key/organising ideas associated with geographical perspectives and, at a more specific level, with individual themes, such as those specified for the subject at Key Stage 3 of the National Curriculum for England and Wales: geomorphological processes, weather and climate, ecosystems, population, settlements, economic activity, development, environmental issues, and resource issues.

### **Practical Considerations**

Planning for progression in geographical understanding is affected by various practical considerations, in particular:

- the provision made for geography within the curriculum timetable of individual schools;
- the external requirements for the subject curriculum, such as those specified by national or state/provincial authorities, or for external examinations; and
- various factors relevant to the design of geography courses.

In most secondary schools in England and Wales, geography is taught primarily as a separate subject. As such, it necessarily competes with other subjects for allocations of curriculum time. The average weekly allocation to geography is about 90 minutes for the National Curriculum Key Stage 3 courses, 150 minutes for GCSE courses and 270 minutes for A Level courses (Thompson *et al.*, 2002). Such averages conceal differences between schools, and between different years within the span of a course. This pattern of regular weekly

allocations of time provides an organisational framework that supports progression in learning. However, as noted earlier, for many individual students the opportunity for progression in geography is limited to the first three years, when the subject is a compulsory component of the curriculum. The proportion of students opting to continue with geography in any individual school is likely to be influenced by: how well it has been taught in the compulsory phase; the priority students give to the subject, in the light of their aspirations and the advice given to them by their teachers and parents; and the extent to which their school's organisational framework enables them to include the subject within their preferred selection of courses.

In all three phases of secondary education, external requirements exert a strong influence on the objectives for geographical understanding and the content through which those objectives are pursued. At a general level, there is a degree of continuity in these requirements, in so far as the content specified for the subject is, for the most part, structured thematically; and the 10 themes included in the Key Stage 3 programme of study are also present, in some form or another, in most of the nine GCSE and seven A Level specifications. However, the support which this offers to progression in understanding is weakened by inadequate guidance about the nature and quality of the understanding required, especially for KS3 and to some extent for GCSE, and significant differences in the attention given to particular themes in different specifications. At both GCSE and A Level, the pressure of high stakes assessment inevitably encourages interpretation of the specifications in terms of the demands of examination papers. In practice, therefore, the scope for progression within any individual theme depends on a school's choice of GCSE and A Level geography schemes.

In each phase, the geography curriculum has to satisfy a wide range of demands, arising from the specified objectives and content, and these demands are open to interpretation by, for example, the authors of textbooks, examiners, teachers and students, all of whom are influenced by their own knowledge, experience, interests and assumptions. This is not necessarily a weakness, because some of the interpretations may enrich understanding and help to make it more accessible to learners. However, the potential complexity of geographical understanding in the secondary school curriculum, which is a consequence of the breadth and variety of the subject content as well as the wide scope for interpretation of the specifications, presents a challenge for the planning of progression. For example, often there is a tension between a concern to ensure adequate coverage of the content specified, which favours breadth of treatment, and a concern to develop students' understanding, which often requires depth of study. Determining what specific content to include, what depth of learning to aim for, and how to structure content and activities to achieve a range of goals, inevitably involves selection and compromises.

### **Theoretical Considerations**

While little theoretical attention has been given to the curricular implications of seeking to improve progression in the geographical understanding of students in secondary education, pertinent aspects of progression in learning figure in a number of general conceptual models. These are models which focus largely on:

structuring the curriculum to enhance progression; achieving a satisfactory match between the demands of the curriculum and the capabilities of students; and identifying the qualities that are most closely associated with progression.

The challenge of structuring courses to support progression in learning has often been viewed in terms of how best to sequence content. In the curriculum reform movement of the 1960s and 1970s, in the USA, UK and elsewhere, many subject based curriculum projects, particularly in mathematics and the sciences, attempted to identify the key ideas and conceptual networks from their respective academic disciplines which might help to structure school curricula. However, while recognising the value of the disciplines as potential sources of ideas for the school curriculum, many curriculum developers and theorists emphasised that the logical structures derived from advanced research do not necessarily indicate the best sequence in which to introduce ideas to students. Phenix (1964) outlined three reasons why it is difficult to determine teaching sequences on the basis of such structures: first, there is no single logical pattern that must be used for any given field of enquiry – any number of conceptual schemes may be devised; secondly, logical structures only provide a set of relationships among the various components of a discipline – they do not dictate the order of teaching; thirdly, it is necessary to distinguish between two types of logical pattern – an order of discovery, which leads from the known to the unknown, and an order of analysis, which moves toward a more critical perspective on the known.

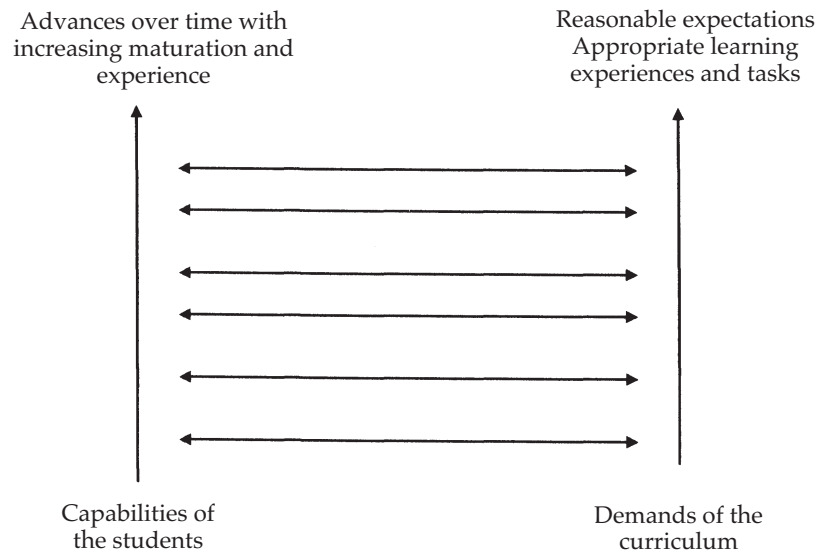
The planning of learning sequences was also addressed by Gagne, who, like Bloom and his associates, worked mainly within the neo-behaviourist tradition of educational psychology, and approached understanding primarily through cognitive skills. He hypothesised that such skills are acquired hierarchically, and presented a *general hierarchical model* containing eight types of learning: signal learning, stimulus-response learning, chaining, verbal association, discrimination, concept learning, rule learning, and problem solving (Gagne, 1962). He suggested that the higher levels of the hierarchy could be applied to many of the subjects taught in schools; and that where such hierarchies could be identified, it should be possible to analyse tasks in order to identify the pre-requisite learnings for a given objective. The findings of such analyses could then be used to inform the planning of sequences within specific content areas (Gagne, 1970). Later, White and Gagne (1974: 23) acknowledged that most of the actual investigations into *learning hierarchies* had 'been concerned with quantitative skills that would generally form part of mathematics and science curricula in schools', and that the chance of finding hierarchies in other subjects, with the possible exception of language skills, might be low. That does not negate the value of analysing intended learning, as a preliminary to planning more effective teaching strategies and learning activities. But it seems likely that the advantages of a strategy involving very tight learning sequences may be limited to particular types of sharply defined, short term objectives. Planning for progression towards long term, broadly defined goals requires a more flexible structure, such as that of the 'spiral curriculum' proposed by Bruner (1960) and Taba (1962). In this model, progression is linked to carefully selected recurrent elements, such as themes, ideas and skills, which are conceived as forming threads that weave through a

programme, linking various units of study to provide the means, for example, to reinforce, extend and refine understanding.

Many curriculum structures are underpinned by an implicit assumption that students are capable of transferring what they have learnt in one context to other contexts which are not identical to the first. The value of *transfer of learning* is that it enables students to use what they have learnt 'to solve new problems, answer new questions, or facilitate learning new subject matter' (Mayer, 2002: 226). While transfer of learning has more often been investigated in relation to skills, it is also relevant to the development of understanding. The application to a new context of a general idea, which was introduced earlier in a different context, may not only shed additional light on the new object of study, but also help to extend and deepen the students' understanding of the idea. That idea then becomes a more powerful tool for those students. But transfer of learning does not take place automatically. Teachers need to identify which ideas are suitable for transfer; develop strategies which help their students acquire a satisfactory initial grasp of meanings; and provide opportunities for them to explore application to other content and contexts. Research evidence suggests that transfer of an idea is more likely to succeed when students' initial understanding is well grounded in a good introduction, within which the idea is applied to a variety of contexts (Bansford *et al.*, 1999). An effective strategy for transfer of learning over a fairly long period will depend, to some extent, on students developing their long-term memories; and that itself may depend on how often particular ideas are encountered and used in a geography course. While the structure of a course can be designed to include episodes in which there is a specific focus on a given key idea or cluster of ideas, other episodes can present opportunities to return briefly to them, in order to reinforce or slightly extend understanding. Some such opportunities can be planned, while others may arise unexpectedly.

Probably the most widely accepted principle underpinning planning for progression is that there should be a reasonable *match between the capabilities of students and the demands of the curriculum* (Figure 2); and that teachers' objectives, expectations and strategies should, therefore, take account of the ways in which students' capabilities develop.

As students mature, they not only gain in experience and in knowledge, understanding and skills, but also develop interests, attitudes and values (Williams, 1997). The challenge, at any given stage, of matching the demands of the curriculum to the developing capabilities of students, is obviously affected by the extent to which there are differences between students in their experience, capabilities and interests. Effective match may require significant differentiation in the teaching programme and in the support provided for individual students or groups of students. The idea of curricular match can be interpreted as meaning that, not only should demands be realistic, in the sense that the understandings and skills intended should be within the reach of students, but also that they should lead students forward. The curriculum should aim to improve the capabilities of students, not merely reflect them. The extent to which students might reasonably be expected to improve their performance, given adequate guidance and support from a teacher, has been labelled 'the zone of proximal development' (Vygotsky, 1962). The term 'scaffolding' was introduced by Wood *et al.* (1976) to describe the sort of support which is required by learners to advance



**Figure 2** A matching model of progression

their development (Hodson, 1998). The idea is to gradually reduce this supporting structure as students learn to operate independently.

Research into the cognitive capabilities of students of different ages, based on their responses to specific tasks, led to claims for 'stages of development' and 'levels of attainment'. Belief in the former was encouraged and informed by Piaget's model of *stages of cognitive development*, which identified a sequence of stages and sub-stages, each characterised by a coherent pattern of mental activities, through which individuals progress. Piaget claimed that the sequence could not vary because each stage is a culmination of what is prepared in the preceding stage; and each supplies the necessary foundation for the next (Tomlinson-Keasey, 1982). Piaget explained the development of cognitive stages as an outcome of processes of assimilation, accommodation and equilibration. Assimilation occurs when people are able to incorporate new ideas, information or experiences into their existing mental structures, while accommodation involves an adjustment of these structures in order to deal with a new situation which cannot be simply assimilated. Equilibration is the more radical shift in thinking which enables an individual to advance from one stage to the next; and involves transformation of the individual's cognitive structures. However, some of Piaget's ideas, particularly the model of cognitive stages, have been much disputed (Bliss, 1995; Brown & Desforge, 1977; Modgil & Modgil, 1982; Phillips & Soltis, 1998); and several prominent educational researchers have concluded that the different qualities of response observed by Piaget and his associates reveal *levels of performance* rather than stages of development (Biggs, 1980, 1999; Biggs & Collis, 1982; Entwistle, 1979, 2000; Peel, 1971, 1972).

Biggs and Collis proposed a taxonomy based on a 'structure of observed learning outcomes' (SOLO), which would be task specific, unlike Piaget's stages of development, which they described as a 'hypothetical cognitive structure'

(HCS) that could not be observed. They presented their SOLO taxonomy as a descriptive model, which would be relevant to teaching because it offers a way of analysing what is meant by quality of response. The model suggests five levels:

- (1) *Pre-structural* – response lacks any logical relation; does not engage with the task; or is tautological, inconsistent, confused.
- (2) *Uni-structural* – presents one relevant, logical factor from the information available, but ignores all others.
- (3) *Multi-structural* – identifies several relevant factors from the information provided, without recognising any relationships between them.
- (4) *Relational* – includes all relevant data and their interrelationships; generalises or draws conclusions from the information provided.
- (5) *Extended Abstract* – introduces an abstract principle, which is not given directly in the data, to build a hypothetical logical structure that includes all the relevant data and their interrelationships; uses this structure to deduce several alternative outcomes; conclusions are held open or qualified to allow logically possible alternative outcomes.

The taxonomy is similar in many respects to the levels suggested earlier by Peel and his research associates (Peel, 1971, 1972), who investigated the responses of school students to problem solving tasks in a range of academic subjects. In most cases, the sort of criteria which appear to determine the levels identified by the researchers are: whether the respondents actually address the tasks that are set; how well they draw upon the information which is presented to them; whether they recognise pertinent relationships; whether they are able to go beyond the information provided, by drawing upon their prior experiences and ideas; the quality of their reasoning; and the comprehensiveness and coherence of their responses. The levels are based on the effective use of general cognitive skills. There is little published evidence of research into students' progression in geographical understanding, related to stages of development or levels of performance, with the notable exceptions of the application of Piaget's ideas to the development of map skills (Boardman, 1983; Downs & Liben, 1991; Downs *et al.*, 1988), and of Peel's ideas to students' understanding of various geographical aspects of farming in different parts of the world (Peel, 1971; Rhys, 1972, 1973).

One approach to analysing curricular demands, which can address more directly the ideas, experiences and information which students are expected to understand, is to identify and explore the various dimensions, or qualities, associated with progression in understanding. A number of attempts have been made to apply the idea of *dimensions of progression* to geographical education (Bennetts, 1981, 1995, 1996, 2005; DES/WO, 1990; HMI, 1986; QCA, 2000; SCAA, 1994). In the light of the analysis of understanding outlined in this paper, it now seems to me that the most significant dimensions of progression in geographical understanding are:

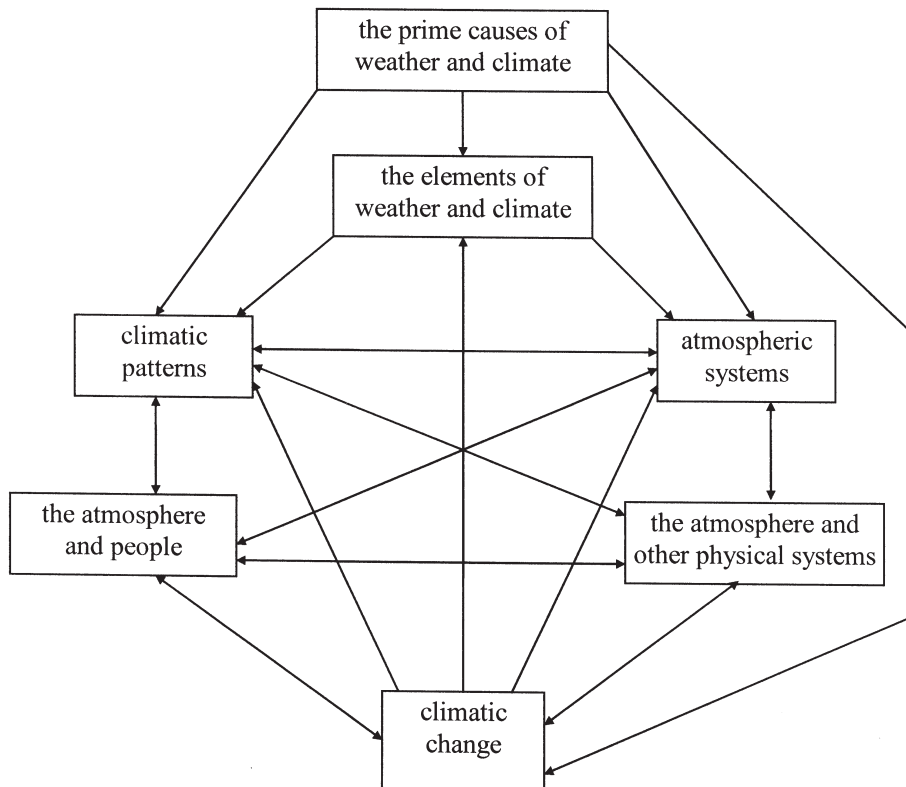
- distance from experience, in the sense of the gap between what is required to be understood and what students have experienced or have knowledge of;
- complexity – whether of experience, information, ideas or cognitive tasks;
- abstraction – particularly of ideas about processes, relationships and values, but also of forms of presentation;

- precision, in the sense of being more exact, and knowing when that is appropriate and useful;
- making connections and developing structures – ranging from applying simple ideas to experience and making simple links between ideas, to the use of sophisticated conceptual models and theories;
- the breadth of context in which explanations are placed, especially spatial contexts, but also temporal and other contexts;
- the association of understanding with cognitive abilities and skills; and
- the association of understanding with affective elements, such as attitudes and values, and the value-laden nature of particular ideas.

The dimensions listed above are interrelated in complex ways, and any particular geographical study may involve a number of them. The relevance of the dimensions to progression in understanding, within individual content themes, can be illustrated by reference to the example of weather and climate.

### Progression in Understanding Weather and Climate

Weather and climate is a complex field of study, offering potential scope for a wide range of contributions to the curriculum, and a variety of alternative routes towards educational goals. Figure 3 highlights some of the most important content subfields within the theme and the links between them. It is not so much



**Figure 3** A content framework for the study of weather and climate in geography

a map of the territory, as a general framework within which understanding can be analysed. Each of the boxed components in the framework has distinct conceptual networks which can help students make sense of the working of the atmosphere, and of the relationships and interactions between the atmosphere and other components of the environment, including human beings. In this paper, the idea of dimensions of progression will be explored in relation to five subthemes which are prominent in secondary education:

- water in the atmosphere – one of the main elements of weather and climate;
- mid-latitude weather systems and air masses;
- the global energy balance and general atmospheric circulation;
- types of climate; and
- natural hazards associated with weather and climate – an example of relationships between the atmosphere and people.

Two of the subthemes, water in the atmosphere and types of climate, are present in the specifications for KS3, GCSE and A Level; two others, mid-latitude weather systems and hazards associated with weather and climate, are prominent at GCSE and A Level; while the global energy balance and general atmospheric circulation are generally restricted to A Level.

### **Water in the atmosphere**

While students in the UK are likely to have experienced many of the atmospheric forms of condensation and precipitation (e.g. dew, frost, fog, clouds; rain, snow and hail), and may recognise some of the conditions associated with their formation, they cannot draw on direct experiences to make sense of the processes that produce such forms. Explanations of these processes involve abstract ideas about the state of the atmosphere and the relationships between the parameters that influence it, such as the concepts of water vapour, absolute and relative humidity, evaporation, condensation, precipitation, adiabatic processes, lapse rates, and the stability of the atmosphere. While some of these ideas are not expected to be understood until at least A Level, others are open to a simple level of understanding at an earlier stage. Some GCSE specifications appear to require a degree of understanding about processes involved in the formation of rainfall or precipitation, but there is little evidence of any consensus about when particular ideas should be introduced and how they could be developed from one stage to the next. The dimension of complexity is relevant to progression in understanding the spatial and temporal patterns of the different forms of atmospheric condensation and precipitation, as well as of the variety of conditions and processes that produce them. These are patterns that operate at a range of spatial scales, and a range of temporal scales.

### **Mid-latitude weather systems**

The use of the Bjerknes model to make sense of the changeable weather patterns of mid-latitudes, with their variable succession of depressions and anti-cyclones, demonstrates the potential value of a conceptual model to help students make connections between ideas, and thereby begin to understand significant relationships within complex phenomena. When students are introduced to such a model, it is important that they learn not only about the internal

structure of that model, but also how the necessarily abstracted form of the model relates to the complex reality which it represents. At GCSE level, the study of depressions and anticyclones usually includes the use of weather maps, which requires some knowledge of map conventions and appropriate map reading skills. However, the interpretation of such maps requires relevant knowledge and understanding, and the cognitive ability and skills to apply these. The depth of understanding of depressions and anticyclones is enhanced by an appreciation of how air masses influence their formation and the character of the weather associated with them. At present only two of the nine GCSE specifications include air masses in their content, although, like many concepts, it is open to different levels of understanding.

### **The global energy balance and general atmospheric circulation**

The sort of challenges posed by the Bjerknes model – the fact that relevant direct experience does not relate to the system as a whole, but only parts of it; the complexity of the interrelationships described by the model; the abstract character of many of the contributory concepts; and the difficulties of relating an abstract model to the variety of conditions and changing patterns observed in the atmosphere – are significantly more demanding in the case of the global models of the atmosphere's energy balance and general circulation. These models provide keys to our understanding of the links between the solar energy received at the edge of the Earth's atmosphere, the latitudinal imbalance in net radiation at the Earth's surface, the redistribution of heat by wind systems and ocean currents, and the global system of climatic patterns. Central to both models is the idea of 'dynamic equilibrium', which, although it is important to many fields of study, appears to be a difficult concept for students to grasp until they can operate as mature thinkers (Peel, 1971). The gradual extension of students' understanding of the causes of rainfall, by means of a content sequence that leads from (1) the local conditions which trigger rainfall by forcing air to rise – relief, convection currents and weather fronts; to (2) the structure and functioning of mid-latitude weather systems; and, finally, to (3) the general atmospheric circulation, is an example of progression based on broadening the context in which explanations are placed.

However, in such a sequence, which may be spread over a long period of time, the quality of understanding which it is reasonable to expect from students at any given stage will depend on the timing of that stage, what they have previously learnt and their current capabilities.

### **Types of climate**

While weather is the state of the atmosphere over a short time scale, ranging from minutes to a few months, climate is about long-term atmospheric patterns and processes, measured over a period of many years. As young students have only a relatively short period of memory on which to draw, their direct experience of climate is necessarily restricted. The precision required to describe climates accurately, and to differentiate between different types of climate, is dependent on analyses of regular recordings of various atmospheric elements (e.g. temperature, rainfall, wind direction and strength, pressure, humidity and cloud cover) to reveal mean conditions, variations from the norm, and extreme

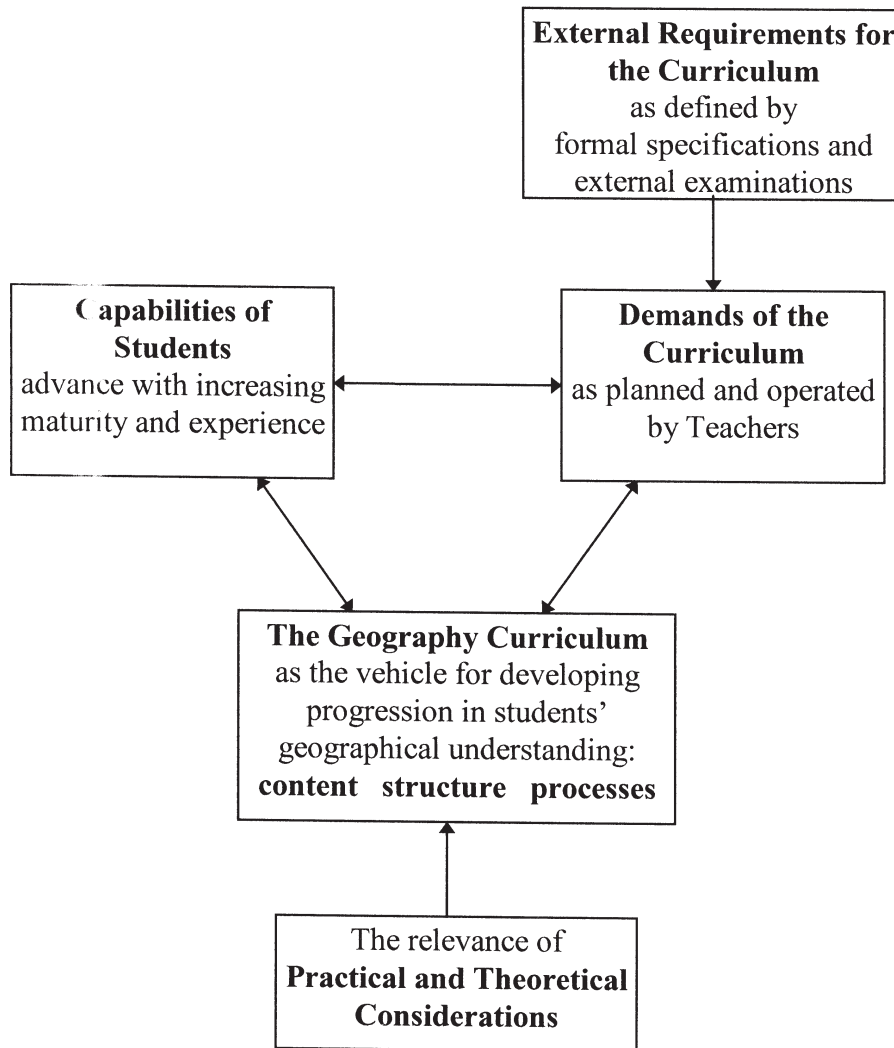
events. There is, therefore, an abstract quality to the concept of climate. There is also abundant scope for complexity, conspicuously so when studying global climatic distribution patterns and their explanation. The main attraction of classifying types of climate has been to make sense of the great variety of weather patterns experienced over the Earth's surface. Such classifications have been much used for teaching purposes, in part because they provide convenient frameworks within which to study the relationships between climate and other aspects of the physical world, and between climate and various forms of human activity. The study of climate becomes more demanding when students are expected to understand the rationale behind a classification, the range of climatic conditions that may exist within a given climatic type or region, and explanations of climatic patterns that extend beyond a relatively static approach which emphasises controlling factors (e.g. latitude, the distribution of land and sea, altitude and relief features, ocean currents, and seasonal patterns of pressure and wind systems), to the dynamics of the global atmospheric circulation.

### **Natural hazards associated with weather and climate**

Natural hazards figure in most GCSE and A Level geography specifications. It is a theme which bridges the physical and human branches of the subject, requiring 'an understanding of both physical and human systems and their interactions with each other, since no hazard can exist unless it is perceived and in turn provokes a human response' (Whittow, 1987: 307). While probably few UK students have direct experience of severe natural hazards, many more are likely to have seen reports of the impact of natural hazards, in newspapers and television programmes. Indeed, the availability of such reports encourages the introduction of content about hazards as a way of stimulating students' interests in particular aspects of physical geography. Progression in relation to geographical studies of natural hazards involves understanding, not only the physical characteristics of different hazards, the vulnerability of different environments and places to specific hazards, and the significance of the economic, political and technological capabilities of the societies and communities affected to the impact of hazards; but also the relevance of people's assumptions, beliefs, attitudes and values to their perception of a hazard, and to their behaviour before, during and after a hazard event.

### **Conclusions**

This paper explores some of the challenges faced by geography teachers in England and Wales when they attempt to design curricular structures to support progression in their students' geographical understanding. The absence of any comprehensive, widely accepted model to aid such a task may be related to the difficulties in conceptualising the key elements of 'progression', 'understanding' and 'geography', as well as the difficulties of applying such ideas to the complex task of curriculum planning. Figure 4, which is an attempt to outline, in very general terms, a broad approach to planning for progression, can be viewed as an extension to the 'matching model of progression' (see Figure 2). While continuing to emphasise the importance of the relationship between curricular demands and advances in the capabilities of students, as they gain in experience



**Figure 4** Towards a model for progression in geographical understanding

and mature with age, Figure 4 also draws attention to: (1) the role of the curriculum, with its content, structure and processes, as the educational vehicle through which students' geographical understanding is developed; (2) the influence on curricula of requirements imposed by centralised systems of education or by external examinations; and (3) the relevance of practical and theoretical considerations to planning the geography curriculum and teaching the subject. From the perspective of a school's geography department, the external requirements are an all-pervasive practical consideration, alongside the time, staff and material resources allocated to the subject; and the many practical decisions which are an inevitable part of the processes of curriculum planning and teaching.

Theoretical considerations are related more closely to significant ideas which can inform planning and teaching for progression. They address the extent to which progression in understanding can be guided by the structures of intended learning outcomes, by the ways in which students' cognitive capabilities appear to develop, and by analyses of the qualities which appear to characterise progression in geographical understanding; and how the curriculum can be structured to facilitate progression. In practice, these four elements are interrelated, and no single one provides the key to progression. While the main ideas and conceptual structures of geography are a rich potential source of understanding, they do not provide a map for the school curriculum, not least because the discipline does not have a tight unified structure and, in any case, ideas that appear to be the most stimulating and most productive in current academic research are not necessarily the ones which should determine what is studied in schools, let alone how the curriculum should be structured. The conceptual maps in geography offer many alternative routes for developing understanding. Similarly, at the other end of the curriculum scale, while an analysis of what is involved in the understanding intended for a specific unit can usefully inform the planning of teaching strategies and learning activities, it is open to question whether it can identify the best sequence for progression. Attempts to model the development of students' cognitive capabilities have also failed to produce an adequate blueprint for progression. The claims for an invariant sequence of coherent 'stages of development', as proposed by Piaget, no longer appear to be convincing. While the case for task specific 'levels of response' is stronger, the various general patterns which have been described focus mainly on the strategies that students use in response to open-ended, problem-solving tasks. Recognition of the wide range of qualities/dimensions associated with progression provides a broader perspective, which can be applied to relevant ideas and experiences, as well as to mental processes. A better appreciation of these qualities could helpfully inform some of the detailed decisions which have to be made when designing a curriculum to support progression in learning.

A geography department attracted to the broad concept of a 'spiral curriculum' would need to:

- (1) review its existing curriculum, and the aims and requirements which it is intended to serve, in order to identify important recurrent elements which offer scope for progression in understanding – the 'threads' in the model;
- (2) select which recurrent elements should be given priority in the planning for progression – a limit will need to be placed on the number of elements in order for planning and teaching to be manageable;
- (3) decide, for any selected recurrent element, which units of study will provide suitable foci for the development of understanding, and which may offer a lesser, though still significant, supporting role;
- (4) plan, or revise, each of the units of work which will focus on a particular recurrent element, to strengthen progression in understanding, taking into account: (1) the overall purpose of the unit; (2) the quality of understanding which is appropriate for the age, maturity, experience and capabilities of the students; (3) the ideas, experiences and cognitive activities which could

- contribute to the development of the students' understanding; and (4) the various dimensions of progression relevant to the understanding intended;
- (5) consider how the sequence of units within the geography curriculum can best be organised to enable students build on their prior learning, and to prepare them for future steps in their programme.

Such a strategy, combining elements of research and curriculum development, is well-suited to school-based projects, especially when these operate within an educational system which provides helpful guidance and support. However, there are strong implications for externally imposed curricular frameworks and assessment systems. As the development of understanding requires depth of their study and adequate opportunities for constructive thinking, it can be inhibited by a geography curriculum which is overloaded with content. 'High stakes' summative assessments can have a similar inhibiting effect, especially when they emphasise recall and low level skills, at the expense of understanding and associated higher level competencies (Madaus, 1999). In contrast, suitably designed formative assessments can be used to help students improve their understanding (Black, 1999; Black & Wilian, 1998). It is clear that progression in geographical understanding is a complex matter, which presents a challenge for researchers, teachers and curriculum developers. However, it is a challenge which deserves more attention than it has received so far.

### Correspondence

Any correspondence should be directed to Trevor Bennetts (ujbennets@yahoo.com).

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