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The place of fieldwork in geography and science qualifications

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Executive Summary

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The place of fieldwork in geography and science qualifications across the 14-19 age range remains contested, unclear and sometimes under threat. This report explores these issues and was informed by a one-day, invitation-only workshop that we ran at the behest of the Field Studies Council.

2

We focus on issues relevant for those countries that use GCSEs (General Certificates of Secondary Education) as qualifications for 14-16 year-olds and Advanced Subsidiary (AS) and General Certificate of Education Advanced (A) levels as qualifications for 16-19 year-olds. We hope that this report will also be of value to those working in other jurisdictions that have or are introducing fieldwork at school level.

3

Fieldwork, which can be defined as any curriculum component that involves leaving the classroom and engaging in teaching and learning activities through first-hand experience of phenomena out-of-doors, has a long tradition in geography and in certain of the sciences, notably biology and environmental science/studies.

4

In geography, learning in the 'real world' is thought to be absolutely essential, contributing particular qualities that run through geography's identity as a subject discipline from primary education to undergraduate study. It expresses a commitment to exploration and enquiry, and geography's concern to discover and to be curious about the world.

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In the sciences too, fieldwork is crucial. It can be regarded as that sub-set of practical science that is particularly valuable for introducing students to investigating the complexity and messiness of the real world.

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Despite its benefits for student learning and motivation, fieldwork is perceived by some school managers as expendable; desirable but not a core requirement.

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High quality qualifications in geography at GCSE and AS/A level require that students have experienced, from start to finish, a first-hand geographical investigation of a specific aspect of the world.

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In geography, the individual study should be the method of assessment of fieldwork at AS/A level. At GCSE, where the 2014 criteria provide no option but to assess fieldwork through terminal examination, the potential of enhancing the place of fieldwork in specifications in a way that invests in curriculum and pedagogic advancement should be examined further, for example through the use of moderated student portfolios.

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In the sciences, at both GCSE and AS/A level, it is important that practical work, of which fieldwork is a unique component, is subject to high quality assessment. The use of moderated student portfolios for the assessment of fieldwork has many strengths and should be explored to see if it can be introduced as a component within formal, summative assessment.

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The more widespread practice of excellent fieldwork in the sciences and geography will require enhanced initial teacher education and subsequent teacher professional development. It takes time to become a teacher who can ensure that students have an outstanding fieldwork experience.

Introduction

The place of fieldwork in geography and science qualifications across the 14-19 age range remains contested, unclear and at times under threat. This is despite the fact that, as we discuss below, it has long been known that well-conducted fieldwork can make a tremendous difference to the learning and motivation of students (and has been a statutory part of the National Curriculum since 1991 and a requirement of examinations in geography for decades). Accordingly, the Field Studies Council (FSC) decided to commission the two of us, one a geography educator and one a science educator, both with long-standing commitments to high quality fieldwork, to write a short report on the issue. We agreed with Steve Tilling, FSC Director of Communications at the FSC, to convene a one-day, invitation-only workshop. In advance, we sent out large amounts of reading (referenced, along with other material, in the Bibliography below) and this was supplemented by a number of those attending the workshop.

Something of the importance of the issue and the timeliness of the work is indicated by the fact that an exceptionally high proportion of those we invited to the workshop came to it, frequently also providing detailed written submissions. Furthermore, a number of those unable to come subsequently provided comments on the draft report. The workshop itself comprised a sequence of intensive group discussions and plenary feedback, underpinned by a considerable body of research evidence plus extensive direct experience of teaching and examining. Some of this work was conduced in separate sessions for geography and science, some of it in sessions where representatives of these subjects worked together. As will be clear, we have focused on issues relevant for those countries that use GCSEs (General Certificates of Secondary Education) as qualifications for 14-16 year-olds and Advanced Subsidiary (AS) and General Certificate of Education Advanced (A) levels as qualifications for 16-19 year-olds. At the same time, we hope that this report will also be of value to those working in other jurisdictions.


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The case for fieldwork

Fieldwork, which can be defined as any curriculum component that involves leaving the classroom and engaging in teaching and learning activities through first-hand experience of phenomena[1], has a long and firmly established place in British geography education[2] . Linking to this tradition Alastair Bonnett[3] asserts that "Geography wants to take children outside the schools and into the streets and fields … and into the rain or the sunshine" (p 80). The Geographical Association's 'manifesto' for geography in schools , together with the Royal Geographical Society's long standing and unwavering support for fieldwork, leaves us in no doubt that learning in the 'real world' is thought to be absolutely essential, contributing particular qualities that run through geography's identity as a subject discipline: its commitment to exploration and enquiry, and its concern to discover and to be curious about the world.

In the sciences too, fieldwork, as defined above, is crucial. It is sometimes likened to laboratory work such that 'the field' for geographers is the equivalent of 'the lab' for scientists. However, fieldwork is better regarded as a sub-set of practical science. As Duncan Hawley writes, "… there are differences. It is in the nature of laboratory and classroom experiments to separate objects from their environments … But in the 'natural' sciences it is only by putting objects and laws in particular contexts that we can see how they work in terms of empirical effects" (p 88). Thus, as one of the workshop participants put it, field work is one distinct component of learning science: "not all science happens in test tubes and young people need to realise this".

In both the sciences and geography there is abundant evidence to show that fieldwork is highly rated by students. Thus for example, Amos and Reiss[6] report that out of eleven alternative strategies for learning science, 'going on a science trip or excursion' was rated by students as the most enjoyable way of learning and the fifth most useful and effective. In geography at all levels, including Higher Education, there is widespread agreement that fieldwork at its best can raise motivation, reduce anxiety about learning and encourage deeper rather than more surface approaches to learning. It frequently provides memorable experiences and commitment to seeing through an enquiry from start to finish, often reliant on working in teams and combining efforts[7].

In view of these opening remarks it may be considered odd therefore that fieldwork's place remains 'contested, unclear and under threat'. We are not going to spend much time in this report analysing why this is so. The fact is that geography and science can be done (although we argue imperfectly) without venturing into the field: fieldwork is therefore perceived by some as expendable; desirable but not a core requirement. Fieldwork is sometimes seen by school management as expensive in terms of monetary cost and curriculum time; some also argue that the opportunity costs are too high in terms of risk management and organisation. And then there are a number of more technical challenges associated with fieldwork in the context of formal qualifications structures such as the GCSE and A level examinations: how do we assess fieldwork? What do we assess and how do we ensure validity and reliability in whatever mechanisms we devise for the assessment of fieldwork?

Some of the issues mentioned in the previous paragraph are daunting and in the general context of the somewhat manufactured anxiety about the efficacy of coursework assessment in the public examination system there appears to be something of a groundswell of opinion that fieldwork may well have become an unaffordable luxury in the search for higher standards and 'rigour'. The participants of the workshop were unanimous in rejecting this view. Even though some experts acknowledged the occurrence of negative backwash arising from a high stakes examination – for example, encouraging 'formulaic' and by implication poor quality fieldwork experiences in some centres – this is not an acceptable reason for compromising the potential of geography and science qualifications to ensure the continuance and development of fieldwork in British education, an aspect that has genuinely high international regard[8].

Before discussing particular technical questions regarding fieldwork and examinations, we therefore refine and extend the principles underlying the case for fieldwork made in the opening paragraphs of this section. The argument we make is that through its unique nature fieldwork offers benefits to students that are of profound importance. Indeed, such is the significance of fieldwork that we argue that it is an essential part of a high quality qualifications structure.

Fieldwork is therefore more than a mere 'signature pedagogy' in geography and the sciences. It brings conceptual, cognitive, procedural and social gains much of which would be lost without the particular opportunities fieldwork provides[9]. Thus:

- Conceptually, fieldwork encourages us to understand that phenomena have a 'history' discernable through traces in the environment, often hidden or difficult to perceive but an essential part of understanding change and continuity in settings that have not been pre-mediated (for a textbook, website or even virtual fieldwork package).
- Cognitively, such fieldwork demands the application of thought processes that are very difficult to recreate in the classroom; for example, using data that may be incomplete and provisional, synthesising multiple forms of data and being tentative in drawing conclusions.
- Procedurally, it is important for students to witness and be part of interpretive science and geography, where variables cannot be tightly controlled and where arguments need to be weighed.
- Certain social gains derived through fieldwork form highly valuable soft outcomes of the study of geography or science at school: we focus here on the social construction of meaning through collaborative enquiries. Done well, fieldwork engages students in the iterative processes of drafting and redrafting data collection instruments (including the identification of good questions to investigate) as well as analysis and drawing conclusions; that is, situations where students learn with and from each other as well as with and from their teachers.

In summary, the workshop discussed the 'compelling case' for fieldwork in the sciences and geography under four interlocking headings. In revised form these are:

The use of (and investigation of) 'real world' settings[10]

- Understanding the uniqueness of place context
- The motivation of working in unfamilar settings (includes 'awe and wonder')
- Experiencing the 'unfamiliar' in the familiar/local context, and stimulating curiosity
- Understanding through direct experience and/or observation of the world, linking theory and practice

Application and evaluation of knowledge, understanding and skills in 'messy contexts'

- Deepening awareness of variability, data handling and statistical modelling
- Encouraging caution in explanation, drawing conclusions and decision making
- Exploring 'ways of seeing' (surface appearances can deceive)
- Using (potentially) all the senses to explore landscapes/phenomena

Developing 'real world learning' [11]

- 'Habits of mind': Investigating; Experimenting; Reasoning Imagining
- 'Frames of mind': Curiosity; Determination; Resourcefulness; Sociability; Reflection
- Enabling critical thinking in the 'naughty world' that does not behave as systems and models predict

Social dimensions

- Extended social interaction in meaning making
- Iterative processes (e.g. discussion, redrafting) and 'independent' learning
- Extended cooperation in problem solving and decision making
- Deepen teachers' knowledge of students and their capacities
- Awareness of ethical questions, e.g. with regard to other living things

We do not argue that fieldwork guarantees these points for, of course, there are no guarantees. Neither is it possible to argue that an absence of fieldwork means that none of the above will happen. What we do say is that fieldwork offers a unique circumstance that makes the above much more attainable. The learning experience becomes richer, more textured, memorable and even more vocationally applicable. In the words of one participant fieldwork, when done well can be part of "the antidote to boring school".

Fieldwork within qualifications

This section overviews the place of fieldwork in geography and science qualifications, and some of the current debates.

Geography

There is a long history of fieldwork in geography qualifications for both 14-16 and 16-19 year-olds. This general statement, of course, covers a great deal of diversity and change over the years. Thus, in years prior to present day regulatory frameworks it was possible to undertake an individual fieldwork investigation at AS/A level that would contribute one-third of the final mark – externally marked with a sample of students even being examined orally. That was not the norm and is unlikely to be seen again although it is noted that following the introduction of GCSE in 1986 coursework was in some specifications worth up to 40% of the final mark. Today it is difficult to gain qualifications in geography at 16 or 19 with no fieldwork component although the weighting is now considerably less. Fieldwork is today part of 'controlled assessment' at GCSE (although, this can be avoided by schools that opt to take iGCSE examinations) and is an element of the skills paper for AS/A level.

At the time of writing it is unclear how this situation may change, although it looks likely that at A-level coursework is to be re-introduced. This is welcomed. The possibility of requiring candidates to undertake an independent geographical investigation with a fieldwork component, resulting in extended writing in the form of a report is appealing. Higher education participants at the workshop commented that few undergraduates appear to have much, if any, experience in structuring a coherent and sustained piece of writing on a theme or argument, let alone taking responsibility for identifying questions, data gathering techniques and methods of analysis. There was universal support for a substantial (at least 20%) component of A-level geography examinations being devoted to an independent study requiring a fieldwork component and a report based on rigorous analysis of first-hand data in addition to other sources.

Controlled assessment at GCSE, which replaced earlier versions of coursework assessment to bring greater reliability, has nevertheless been perceived by some to be organisationally challenging and bureaucratic. Its abolition without some form of replacement means that for the first time since the introduction of GCSE, geography qualifications will be entirely the result of terminal examination. This is not favoured and was regarded by workshop participants as a backwards step. Although it is theoretically possible to devise examination questions that assess fieldwork, and therefore on the face of it preserve the notion of compulsory fieldwork at GCSE, the workshop was strongly of the view that such a component will be difficult to achieve with an adequate degree of validity.

The basis for such a forthright conclusion is in the precise nature of what we think are the educational benefits of undertaking fieldwork and what therefore we wish to assess summatively for the purposes of the examination: we pursue this and the accompanying validity question in more detail in the next section. However, we note here the view from one participant (by no means an isolated concern) that devising "fieldwork for assessment purposes is not necessarily the same as fieldwork that is good for geographical understanding". The concern here is that when fieldwork is codified in a manner that is reliable for the purposes of the national qualification framework it can become predictable, 'safe' and formulaic. When this happens the compelling case for fieldwork made in the previous section is undermined; for example, the specification may place a heavy emphasis on readily repeatable and measurable skills and far less on the epistemological dimensions of fieldwork enquiry.

An ideal solution at GCSE for many is to return to coursework and the fieldwork enquiry. Interesting models for this exist including WJEC who still have in place a system to approve fieldwork proposals from centres before the fieldwork is done; other models include various forms of moderation meetings for teachers and examiners (which, of course, serves as excellent continuing professional development [CPD] for teachers). However, current regulatory and/or political objections to coursework assessment have resulted in such a 'coursework' model being unavailable. If we agree that the 'fieldwork examination question' is a false long-term solution for GCSE then we should examine other possible options. These appear to be either to remove fieldwork from the assessment framework altogether or to work with an improved form of controlled assessment.

The workshop considered all options, including whether to examine fieldwork at all, and recommendations are made in a later section of this report. However, it is important to note that discussions pointed to a fairly clear judgement that although it is theoretically possible to require high quality fieldwork to be undertaken by students as a mandatory part of GCSE geography (this could be specified in terms of time allocation and quality criteria) and yet not require it to be directly assessed, this would be, to say the least, a high risk strategy. As one experienced participant commented, without a strong policing mechanism perhaps involving Ofsted but certainly within the regulatory framework, a move away from directly assessed fieldwork would weaken its position:

> I have run 16 CPD sessions for assorted awarding bodies in the last term. Without exception every teacher said that if fieldwork were not directly assessed the students would almost certainly not be allowed out of school in school time to carry out investigations … I do not trust a system whereby Head Teachers would sign a document to say that an appropriate range of fieldwork had been done …

Furthermore, there was also a current of opinion amongst workshop participants that we should not underestimate the power of qualifications-led curriculum and pedagogic development, and that if the specification (based on the underlying criteria and regulatory framework) is right, the backwash impact on practice need not be negative. We return to this point later in the report.

Finally, a pertinent observation was made in the workshop that materials exist on the *progression* of learning through fieldwork and it would be helpful for Ofqual and the awarding bodies to identify the relationship between expectations and standards of geography fieldwork at GCSE and at AS/A level. This could even incorporate KS3 (11-14 years) where fieldwork is a stipulated element of the National Curriculum.

The sciences

In the sciences, it is unrealistic to imagine that most chemistry and physics qualifications are likely to give much place to fieldwork. While both subjects have a long history of fieldwork, this has always been a minority pursuit[14]. However, fieldwork plays a core role in astronomy, in biology, in environmental science/studies and in earth science. It is difficult, for example, to imagine a worthwhile astronomy qualification for 14-16 and 16-19 year-olds that didn't give a central place to observation of the night sky whether with the naked eye, through hands-on telescopes or by the use of robotic telescopes.

Sadly, many students studying the sciences in the 14-19 age range never get out of their classrooms. However, within biology, for example, while it is possible to teach ecology very well in a school laboratory, the subject is hugely enhanced by complementing such activity outside of the classroom, in the field. At its most modest, this may consist simply of mapping and identifying a few species of plants using quadrats on a school lawn. However, even in a city, ecology undertaken on school grounds, or within a very short distance of them, can be far more exciting and intellectually stimulating. Travelling further afield, while it carries the risk of giving the message to students that ecology can only really be undertaken in distant, exotic locations, has a number of advantages. For one thing, it tends to mean that learning is not restricted to a single or double period, thus opening up a much greater range of learning possibilities. Then there is the fact that this allows students to develop such character traits as persistence and patience, and such 'soft skills' as working in groups over more sustained periods than typically required in schools. These benefits, of course, are magnified by residential fieldwork. However, although we would argue for fieldwork to be a central component of both GCSE and AS/A level biology qualifications, we would not argue for this necessarily to be residential. At GCSE, in particular, the practicalities and cost are such that few schools will be able to provide this for all their biology students.

Unlike in a number of other countries[15], earth science occupies only a small space in GCSE science qualifications. While geology is available as an AS/A level, the numbers who take it are small relative to the 'big three' of biology, chemistry and physics. Although AS/A level geology is often seen by universities as advantageous for students intending to read geology / earth science(s) at undergraduate level, it is not a required subject in the way that, for example, chemistry A level nearly always is for undergraduate chemistry / chemical engineering courses. As one would expect, fieldwork is an important component of AS/A level geology[16].


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Assessment

Students' work can be assessed for a number of reasons. For a start, there is the on-going, informal assessment by a teacher (assessment for learning, also known as formative assessment) that enables the teacher to make fine-tuned adjustments to their teaching depending on the feedback they receive from their students. The role of formative assessment in enhancing the learning process is of particular and special significance in fieldwork, for when done well a close, genuinely iterative relationship can build between teachers and students – and between students – who together see an enquiry through from start to finish; typically this will involve much discussion, drafting and redrafting.

Then there is summative assessment where a student's learning (whether for knowledge, understanding, skills or whatever) is determined at the end of some unit of work or course of study. Such assessment may be used for a number of purposes, including accountability measures of teachers or schools. *Here, we are concerned with summative assessment as determined by Awarding Bodies for the purposes of the grading of students in GCSE and AS/A level qualifications.* There is, of course, a tension between the goals and practices of formative assessment and the demands of a national summative assessment framework.

There are two main views with regards to the place of fieldwork within formal, summative assessment at GCSE and AS/A level, both of which emerged in the discussion in the previous section. One is that teachers and students now operate within a system that is so heavily influenced by accountability considerations that if fieldwork isn't a required part of the assessment system, it risks being devalued, with substantially less time and attention paid to it. The other view is that it is not easy to assess fieldwork well at GCSE and AS/A level, in terms of a contribution to the final grade, and that rather than getting bogged down in such assessment, better learning results simply from ensuring that students engage in high quality fieldwork as a core part of their course, without this contributing directly to their final grade.

A related issue comes from recent unpublished work by Ofqual and the Awarding Bodies that indicates that coursework (a standard way in which fieldwork is assessed) currently too often fails as a component within the assessment framework at GCSE and AS/A level. This is for two main reasons. First, the marks awarded are almost invariably heavily bunched towards the upper end of the range; in other words they don't do a good job of discriminating between candidates. Secondly, in some centres too many candidates are unfairly advantaged, for example through receiving help from their families.

Geography

Most research on fieldwork in geography education, and most professional guidance materials in the form of Handbooks and such like[17],is focused on the educational benefits of fieldwork, different approaches to doing fieldwork and on how to overcome the real or perceived barriers to doing fieldwork. What little research evidence there is on progression in fieldwork and how to assess desired fieldwork outcomes[18] is not used overtly to guide assessment design at GCSE and AS/A level; rather, practices have emerged through experience.

One of the issues to have arisen at GCSE is that, as Eleanor Rawling explains in detail, coursework assessment became synonymous with the large-scale fieldwork project. At GCSE this resulted in geographical fieldwork increasingly being seen as burdensome – forming "a virtually separate part of the curriculum and assessment, instead of being seen as an integral dimension to all geographical work"[19]. Furthermore, she reported that as there was insufficient clarity over what is actually being assessed, coursework (fieldwork) was in effect "being defined mainly as a skills exercise" (p 3). This outcome was compounded by attempts by some teachers to manage the burden (for themselves and for students) by providing common approaches and responses for students to use[20]. – leading to formulaic interpretations of fieldwork and devaluing aspects of the activity and its educational potential, as outlined earlier in this report [21].

The profound difficulty and dilemma that this analysis reveals is that although coursework assessment associated with fieldwork was introduced specifically to respond to concerns about validity[22], there is always a trade off to be had: the need for reliability in a national qualifications framework places a limit on validity. The limits placed on validity are greater in a low trust context, as is said to exist today, but to an extent such difficulties could be eased through the careful deployment of adequate resources, including effective (and mandatory) moderation procedures that would focus on criteria for quality fieldwork design in relation to the desired learning outcomes. This could be linked to external marking of individual students' field investigations in the form of portfolios or reports. Another possibility, but arguably carrying more risk of non-compliance, is to externally assess a school submission of fieldwork arrangements that have been put in place, under the signature of the head teacher[23]. The bottom line is that *a student with a GCSE geography qualification can show by dint of that qualification that they have undertaken and experienced a high quality curriculum integrated fieldwork investigation.* It may be possible to contemplate regulations to encourage full compliance with both the spirit and the letter of such a fieldwork requirement; for example, centres (schools) which do not submit and demonstrate satisfactory arrangements for fieldwork could be disbarred from top grades in geography.

The AS/A level examinations should specify an extended individual report based on field research (the latter may, of course, be a collaborative and/or group exercise). In both GCSE and AS/A level any improvement depends on addressing the whole assessment package and not just finding a way to bolt on a fieldwork component.

The sciences

In the sciences, fieldwork assessment can be thought of as simply a sub-set of practical work assessment. Here, we use the term 'practical work' as it is commonly used in the science education literature[24] , namely as an overarching term that refers to any type of science teaching and learning activity in which students, working either individually or in small groups, are involved, as an important element of what they are doing, in observing and/or manipulating real objects and materials as opposed to virtual objects and materials such as those obtained from a DVD, a computer simulation or even from a text-based account [25].

In the sciences, practical work is central both to the appeal and effectiveness of science education and to the development of practical skills that will be of use in Higher Education and/or the workplace. For example, in the UK, the House of Commons Science and Technology Committee reported back in 2002 that:

> In our view, practical work, including fieldwork, is a vital part of science education. It helps students to develop their understanding of science, appreciate that science is based on evidence and acquire hands-on skills that are essential if students are to progress in science [26].

Research in the area of practical work[27] shows the significant influence of the curriculum and, in particular, its associated summative assessment on the practical work that teachers opt to do with their students. Certainly, in England, it has long been recognised with respect to practical work in the sciences[28] that, to a very considerable extent, it is summative assessment that drives what is taught, to the extent that teachers' preferences for using different types of practical work are routinely influenced by their considerations of curriculum targets and methods of summative assessment[29].

Whether or not one believes that practical work in general or fieldwork in particular should be summatively assessed in GCSE and/or AS/A level science qualifications, it remains the case that almost no research has been undertaken on how such assessment might best be undertaken. There is very little, for instance, on the issue in the major science education handbooks[30]. Important work has been undertaken by Richard Gott and Sandra Duggan[31] who concluded that *"there is no easy solution to the assessment problem"* [32]. In particular, it is difficult to devise instruments that generate marks for practical work that are both valid (i.e. they measure what we want them to measure) and reliable (i.e. different markers give the same / very similar marks to a particular piece of work).

Undertaking quality fieldwork

Student qualifications and their assessment are of great importance. However, they are not the be all and end all as far as student learning goes. Even if we restrict ourselves to student attainment, it is clear that a teacher's pedagogy is far more important than the intended curriculum or such structural factors as the type of schooling. As John Hattie has shown in his very large-scale meta-analysis[33], the factors that have the greatest effect on student attainment are in the hands of individual teachers, for example raising student expectations, early interventions, undertaking formative evaluation and providing opportunities for classroom discussion.

Teacher pedagogy, in turn, is no doubt influenced by the content of students' curricula and the attendant assessment systems but is far more influenced by the training provided in initial teacher education and on-going professional development and by those hard to measure factors aggregated into 'teacher effectiveness'[34]. More generally, Tim Oates[35] has produced a list of 13 'control factors', by which he means ways of improving student learning, namely (in no particular order): Curriculum content (national curriculum specifications, textbooks, support materials, etc.); Assessment and qualifications; National framework – system shape (e.g. routes, classes of qualifications); Inspection; Pedagogy; Professional development (levels and nature of teacher expertise); Institutional development; Institutional forms and structures (e.g. size of schools, education phases); Allied social measures (such as that which links social care, health care and education); Funding; Governance (autonomy versus direct control); Accountability arrangements; Selection and gatekeeping (e.g. university admissions requirements).

Geography

In geography the orthodox position shared by a majority of participants at the workshop, is that there should be a clear and unambiguous line of argument. This starts with 'there must be fieldwork' a view shared by virtually all geography educationists and practitioners. The argument then states that to ensure this 'there must be fieldwork assessment' and that therefore a fieldwork component 'must form part of the examination/qualification'. In the recent past this line of argument has been broken at AS/A level to the great detriment of both the experience of what it means to study geography and to standards, not least in preparation for study in Higher Education. Bringing in an extended written report based on field research, counting for 20% of the final examination, is a step that is positively welcomed.

The proponents of the 'unambiguous line of argument' recommend the same, or similar, for GCSE (albeit for a smaller weighting, possibly 10-15%, for reasons that are not clear). Ideally, this would be internally set and marked, and moderated by the awarding body; external marking would be an acceptable second best. This would ensure the presence of fieldwork in GCSE geography, but the question that this line of argument does not address is the one of quality. The compelling case for fieldwork is in several ways contingent on quality (as of course are most other education processes) and in the light of the assessment issues raised in the previous section we should look to controllable factors on Oates' list beyond specifications and assessment regulations. Notably, we should look at teacher education and continuing professional support that ties together thinking and practice in curriculum, pedagogy and assessment. In the context of the qualification framework for GCSE geography, this may be achieved through supporting mandatory local fieldwork design and a sample of student portfolios/assignments to demonstrate outcomes – which may be moderated regionally or nationally, but not necessarily count directly to the final mark of the individual student.

Thus, the three step line of argument from 'fieldwork is essential' through 'it must be assessed', to it must therefore be 'part of the qualification' is preserved. Arguably, by a renewed focus on quality, it is enhanced. The assessment element of the argument is transformed to become much more formative in purpose: this enables the iterative processes alluded to earlier in this report, thus helping teachers achieve the conceptual, cognitive and social gains that are available through fieldwork. Fieldwork is expressed as an essential component of geography GCSE, building on KS3 and the National Curriculum requirement for students to experience fieldwork in geography. Resources formerly devoted to its summative assessment may be diverted to professional capacity building. This could become the hallmark of a world-class qualification in geography.

The sciences

In the sciences, a number of factors mean that high quality fieldwork in the sciences for the 14-19 age range is rarer than we would hope. For a start, few science teachers, other than biology teachers and the much smaller number of astronomy, environmental science/studies and geology teachers, see fieldwork as having a central role to play in science education. Then there is the fact that a smaller proportion of new biology teachers have experience of high quality fieldwork, particularly residential fieldwork, in their undergraduate courses than was the case in the past. To these considerations can be added the familiar litany that teachers spend more time on paperwork nowadays, leaving less time for exciting pedagogies, that risk assessments and other health and safety considerations put some teachers off anything beyond a modest visit to a part of the school grounds, and that high quality fieldwork is rarely recognised by the assessment system.

Having said that, there is room for some optimism. One Higher Education biology participant at the workshop pointed out that undergraduates are extremely positive when evaluating university fieldwork courses and such undergraduate views are being taken increasingly seriously given the advent of substantial tuition fees. Additionally, professional organisations such as the British Ecological Society now provide a range of resources to help with the teaching of fieldwork across the 5-19 age range.

Nevertheless, if current changes to the assessment regime at GCSE and AS/A level mean that practical work in science is seen to be less important in future than has been the case, it was the strong view of those at the workshop that the quality of practical work, including fieldwork, will diminish. This is not what employers, higher education institutions or anyone else wants.

Recommendations, choices and further work

This report makes the case for fieldwork in geography and science qualifications. Mindful of some of the differences between geography and the sciences our final brief recommendations distinguish between these realms, although we are clear that the overall case is exceptionally strong and applies across them.

Geography

Given the deep traditions of fieldwork in school geography and the even deeper disciplinary heritage that fieldwork both preserves and develops though exploration, discovery and 'real world' investigation, this report is unequivocal. High quality qualifications in geography at GCSE and AS/A level require that students have experienced, *from start to finish,* a first-hand geographical investigation of a specific aspect of the world.

Such a demand is not satisfied, let alone guaranteed, by the introduction of even the most carefully designed fieldwork questions in a traditional (sit down, timed, silent) terminal examination setting. In summary this is because experience has shown that:

- Examination questions about fieldwork tend to be formulaic and predictable. They focus on general fieldwork themes and skills such as sampling and investigative methods. They do not allow candidates to show application and enrichment of theoretical knowledge and understanding as it applies to specific place contexts. The fieldwork becomes generalised – actually, the antithesis of what fieldwork is about.
- Assessing fieldwork through examination questions would lead to a narrowing of the curriculum. Some teachers would focus their teaching on the requirements of the examination, which would lead them towards a focus on technique (e.g. sampling) at the expense of deep learning and would in the worst cases allow rote learning of fieldwork theory.
- Even if the examination question approach preserved fieldwork in schools (and it might not as it is unlikely to be of sufficient weighting) the *quality* of fieldwork would be undermined. Generic field skills can be practised within the school grounds, and not necessarily as part of an investigation.

Similar arguments can be directed to controlled assessment, introduced in 2006 to raise the reliability of GCSE examinations – albeit at the expense of validity. Thus, this report has looked at reliability and validity issues associated with *coursework* (which in geography has become synonymous with field investigation). All things being equal, there is a strong case for introducing the individual study and this report unequivocally supports such a move at AS/A level.

At GCSE this report makes a different case. The unequivocal position is that GCSE geography must *require that students experience high quality fieldwork*. The question is how t*he qualification* (rather than the examination per se) can signify that this is case. We note that there is some doubt as to whether controlled assessment achieved this. We can be sure that if the system were ever to drop fieldwork as a requirement, or, as has been announced, build it into the sit-down examination via fieldwork questions, there is a serious risk that fieldwork will wither, even in schools where enthusiastic geography departments are committed to fieldwork. This outcome would be disastrous, not least in terms of subject identity and teacher morale, but also in terms of student achievement.

The principal recommendation at GCSE therefore is to examine the potential of enhancing the place of fieldwork in GCSE specifications in a way that invests in curriculum and pedagogic advancement through teacher development. The objective would be to ensure through the qualification structure that in many more centres than at present the compelling case for fieldwork in geography is fully achieved.

The sciences

Fieldwork has a valuable role to play in all the sciences, and this is especially the case in astronomy, biology, environmental science/studies and geology. In these sciences in particular, qualifications should be designed to ensure that all students experience high quality fieldwork. In most cases this is likely to result from the explicit specification of fieldwork as a requirement of the learnt curriculum.

At both GCSE and AS/A level, it is important that practical work, of which fieldwork is a component, is subject to high quality assessment. It is often the case that fieldwork is well suited to a more holistic form of assessment than obtains elsewhere in school science. In particular, fieldwork cannot adequately be assessed solely through terminal written examinations. Attendees at the workshop were positive about the use of portfolios for assessment purposes as these can encourage students to develop and record a wide range of skills including investigative skills, reasoned arguments, the marshalling and evaluation of evidence and the ability to write extended prose and have far greater potential for differentiation. Such portfolios, especially if electronic, can also include a diversity of materials (for example, short video clips of peer presentations) and encourage the development of such generic skills as persistence, the ability to work in groups and high quality communication.

To ensure the more widespread practice of excellent fieldwork in the sciences will also require changes to enhance initial teacher education and subsequent teacher professional development. It takes time to become a teacher who can ensure that students have an outstanding fieldwork experience. However, the rewards are great. Fieldwork can be transformational for students in their understanding of a subject and their attitudes towards it.

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Endnotes

[1] Boyle, A., Maguire, S., Martin, A., Milsom, C., Nash, R., Rawlinson, S., Turner, A., Wurthmann, S. & Conchie, S. (2007) Fieldwork is good: the student perception and the affective domain, *Journal of Geography in Higher Education* 31(2), 299-317.

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[8] For example, the Ministry of Education in Singapore has invested heavily in developing geography teachers' fieldwork skills: using fieldwork as a basis for a "geographical investigation' (GI) becomes a compulsory element of the secondary curriculum from 2014. See http://www.moe.gov.sg/education/syllabuses/humanities/files/geography-lower-secondary-2014.pdf.

[9] To develop this point further we can refer to the King's College report: Black, P., Harrison, C., Osborne, J. & Duschl, R. (2004) *Assessment of science learning 14–19,* London: Royal Society. https://royalsociety.org/uploadedFiles/Royal_Society_Content/Influencing_Policy/Education/Reports/Kings%20College%20report_web%20July%202004%20update.pdf.

[10] We acknowledge the potential weakness of this phrase; we do not imply, for example, that laboratories or classrooms are fake or 'unreal'. But, as one participant wrote, the 'real world' contains social, political, environmental and cultural 'complexities' that young people can be exposed to – in order to weigh up 'scientific evidence' in relation to 'public opinion' – for example, in relation to flood management or coastal retreat.

[11] This term is from Claxton, G., Lucas, B. & Webster, R. (2010) *Bodies of knowledge: How the learning sciences could transform practical and vocational education,* London: Edge Foundation. http://www.edge.co.uk/media/16982/bodies_of_knowledge.pdf.

[12] Kennedy, B. A. (2006) *Inventing the earth: Ideas on landscape development Since 1740,* Oxford: Blackwell. This is cited in Hawley, 2012 (page 89).

[13] Posters, handbooks and other professional materials have been produced by the Geographical Association over many years, often in conjunction with the Field Studies Council: http://www.geography.org.uk/resources/fieldwork/.

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[15] See, for example, the Next Generation Science Standards in the USA http://www.nextgenscience.org/.

[16] For example, see http://www.ocr.org.uk/Images/77538-specification.pdf.

[17] See, for example, Balderstone, D. (Ed) (2006) *Secondary geography handbook,* Sheffield: Geographical Association; Lambert, D. & Balderstone, D. (2010) *Learning to teach geography* (2nd edition), London: Routledge; Kinder, A. (2013) What is the contribution of fieldwork to school geography? In Lambert, D. & Jones, M. (Eds) (2013) *Debates in geography education*, Abingdon: Routledge.

[18] Indeed, in the research forum edited by Nick Foskett, research on the assessment of fieldwork outcomes was not even called for, such is the overriding priority to clarify its purposes and justification in schools: Foskett, N. (1999) Fieldwork in the geography curriculum – international perspectives and research issues, *International Research in Geographical and Environmental Education,* 8(2), 159-163.

[19] Rawling, E. (2006) *Improving internal assessment: Geography.* Consultant report produced for the Qualifications and Curriculum Agency (Review of Coursework, 2006).

[20] Ofqual reported, in its review of controlled assessment, that geography teachers were more likely than average of teachers across all subjects to stress problems with time-tabling, managing student numbers and access to ICT resources: Ofqual (2011) Evaluation of the Introduction of Controlled Assessment (page 72).

[21] It is worth noting here that during the 1980s when GCSE was introduced, in the years following three exceedingly successful Schools Council curriculum projects in geography, there was a widespread understanding of the importance of linking assessment and curriculum development. It was accepted that teachers could not be expected to develop the latter without involvement in the former – and that teachers' interpretation and use of assessment criteria was enhanced when curriculum-assessment links were prioritised, rather than seen as separate, as has increasingly been the case in latter years.

[22] For example, Caroline Gipps and Patricia Murphy explain that coursework arose in response to concerns about the validity of the context of (external) terminal examination assessment, in particular whether all pupils' achievements could be revealed under pressurised, timed, test conditions and, indeed, whether all aspects of a subject could be assessed in this way: Gipps, C. & Murphy, P. (1994) *A fair test? Assessment, achievement and equity,* Oxford: Oxford University Press.

[23] This proposal in effect is passing to teachers a significant professional responsibility that awarding bodies would need to support though 'moderation' and professional development activities (face to face and on-line). The school submission for external assessment may include a sample of students work to illustrate the depth and range of outcomes. For this proposal to work it would need the full endorsement of the regulatory authority, Ofqual.

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[32] Gott & Duggan (2002), page 16.

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[34] See the RAND Teacher effectiveness website http://www.rand.org/topics/teacher-effectiveness.html and the Sutton Trust / Education Endowment Foundation Toolkit on how to improve the attainment of disadvantaged pupils http://educationendowmentfoundation.org.uk/toolkit/.

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