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Science at Key Stage 4

1. Introduction

This study was conducted over the period from September 1993 to June 1996 and followed the first, second and third cohorts of pupils into or through Science at Key Stage 4. The research had 2 distinct strands: a statistical survey, across Northern Ireland, of the provision and uptake of science courses at Key Stage 4 and an in-depth study, in 30 schools, of the implementation of these programmes.

2. Main Findings:the Statistical Survey

The Science at Key Stage 4 courses offered by schools to pupils in Year 11 are shown in Table 1.

Table 1 Science provision at Key Stage 4, as reported by schools, across Northern Ireland by school type and by cohort.

Course or Course Combination	First Cohort		Second Cohort		Third Cohort	
	NS	S	NS	S	NS	S
Single Science	16	0	14	0	11	0
Single/Double Science	127	3	133	3	135	4
Double Science	6	15	5	14	6	13
Single/Double/Triple Science	6	14	3	19	4	24
Double/Triple Science	0	37	0	32	0	26
Triple Science	0	1	0	1	0	0
Single/Triple Science	0	0	0	1	0	3

NS Non-selective schools
S Selective schools

The uptake of these Science at Key Stage 4 courses is shown in Table 2. This pattern is strikingly different from that in England and Wales, where, in 1994, about 10% of pupils followed single science, about 80% followed double science and about 7% followed separate science programmes.

Table 2 Science uptake at Key Stage 4, as reported by schools, across Northern Ireland, by cohort and by school type.

Number and percentage of pupils	Single Science	Double Science	Triple Science	Total
First cohort of pupils	10,464 41.1	12,591 49.5	2,400 9.4	25,455 100
Second cohort of pupils	11,725 44.2	12,334 46.5	2,487 9.4	26,546 100
Third cohort of pupils	11,715 45.0	11,764 45.1	2,578 9.9	26,057 100
The uptake of science by school type for the:				
First cohort of pupils				
Non-selective schools	10,080 62.9	5,822 36.3	135 0.8	16,037 100
Selective schools	384 4.1	6,769 71.9	2,265 24.0	9,418 100
Second cohort of pupils				
Non-selective schools	11,087 65.2	5,849 34.4	74 0.4	17,010 100
Selective schools	638 6.7	6,485 68.0	2,413 25.3	9,536 100
Third cohort of pupils				
Non-selective	10,861 65.2	5,710 34.3	96 0.6	16,667 100
Selective schools	854 9.1	6,054 64.5	2,482 26.4	9,390 100

During the period of the survey the percentage of Key Stage 4 pupils studying single science increased and that of those studying double science decreased. There was a slight increase in the percentage of pupils studying triple science, though this included some concentrating on two disciplines rather than three.

More boys than girls take single science at Key Stage 4 and more girls than boys take double science. Boys predominate in triple science programmes. For the third cohort of pupils, the average number of sciences studied by girls at Key Stage 4 exceeded that studied by boys.

3. Main Findings: The In-Depth Study

Firstly, mention must be made of the conspicuous dedication which characterised teachers in the survey schools as they wrestled with the difficult issues of major curricular change. Science at Key Stage 4 has been implemented with commitment and concern for pupils' success.

In general, overcrowding of the Key Stage 4 curriculum has been recognised as an issue since its inception. Science, however, has posed particular problems. Science at Key Stage 4

is required to fulfil two principal functions. Firstly, it should equip every pupil with knowledge and skills relevant to life in a society increasingly shaped by science and technology. That is, it is required to promote what is often termed 'scientific literacy'. It is on this basis that the subject is compulsory in the Northern Ireland Curriculum. Secondly, it is required to prepare some pupils also for further study in science, including advanced study in the separate sciences. There is a tension between these 2 distinct purposes for Science at Key Stage 4 and this emerged as a major issue in the implementation of its Programmes of Study.

Schools also had to overcome problems stemming from late announcements relating to the recognition of syllabuses and to the assessment arrangements for the least able pupils. For some, guidance in respect of the assessment of coursework was also issued late.

Despite this, there has been a wealth of positive outcomes of Science at Key Stage 4. Prior to its introduction, there were some who gave up science at age 13/14 and about two-thirds of the rest failed to follow a broadly-based science course. There were many girls who discontinued physics and many boys who discontinued biology at this early stage. As a consequence, these young people missed out on important scientific ideas which have value in everyday life and they were precluded from pursuing these subjects post-16. The introduction of Science at Key Stage 4 has seen all pupils, girls and boys, studying astronomy, biology, chemistry and physics up to the age of 16. Thus all have had the opportunity to gain knowledge and skills which may help them make sense of science-related events, claims and concerns in their daily lives.

For those who have achieved good grades in double science and triple science, the option has been kept open to study any or all of biology, chemistry and physics at advanced level. Furthermore, for those who have followed a programme of double science, this advantage has been achieved in the context of a broad and balanced overall school curriculum. This deferment of decision-making to 16 is particularly significant, given that the survey found evidence of a marked instability of pupils' subject preferences and career intentions from Key Stage 3 to Key Stage 4.

In Northern Ireland, unlike England, the increased participation of pupils in the sciences up to age 16, accompanied by the deferment of choice among the sciences, has translated into an increased number of students, as reported by schools, taking A levels in biology, chemistry and physics, for the first cohort to feed forward from Key Stage 4. In addition, while girls still predominate in biology and boys in physics, these sex effects diminished slightly. Overall, an increased number of girls continued with the sciences beyond 16. The number of students taking GNVQ Science also increased. It must be noted, however, that these represent results from one year only, and it is therefore too early to construe them as a trend.

The majority of young people in the survey schools found Science at Key Stage 4 to be interesting, accessible and relevant to their daily lives. Some pupils indicated that they valued the opportunity to learn about all 3 sciences. Many referred to their enjoyment of practical work. There was a strong link between relevance and interest and, indeed, between interest and learning. Investigations were popular with pupils and provided them with opportunities to work independently, to see a task through to completion and to prepare a report of which they could be justly proud. For many, the newly introduced topic of astronomy stimulated their curiosity and sense of wonder.

Prior to its introduction, there was much apprehension about the appropriateness of Science at Key Stage 4 for lower attaining pupils. The findings of the survey would suggest that, to some extent, these fears were unfounded. The limited grade GCSE Science: Single Award (Modular) syllabus provided by CCEA, in particular, proved popular with pupils and their teachers, and pre-GCSE syllabuses, for example the WJEC Certificate in Education in Scientific Achievement, met the needs of some who were unlikely to demonstrate sufficient positive achievement to be graded at GCSE. There is a need, however, to monitor the numbers taking such courses.

Though Science at Key Stage 4 has demanded more of our young people than has been the case in the past, pupils' results in its first external examinations were encouraging. Furthermore, the qualifications gained represent performance across the three major science disciplines, and there was evidence from this survey that most pupils worked with consistent effort and effect in biology, chemistry and physics. Such achievement is a tribute to the examination candidates, but it is also a testimony to the professionalism of science teachers in Northern Ireland.

There remain, however, problems with Science at Key Stage 4 as it was prescribed, perceived and presented at the time of this study.

Too many of our young people take single science, so limiting the breadth of their study and precluding them, effectively, from advanced study in the sciences. Those taking the triple science programme enjoy a broad experience of biology, chemistry and physics, and are well-prepared for advanced study in these subjects. However, they pay a heavy price in terms of the restrictions this places on other option choices at Key Stage 4 and breadth and balance in their overall curriculum is thereby diminished. Furthermore, in some schools there was a substantial number of pupils who pursued a triple science programme, only to discontinue their studies in science altogether, post-16.

Double science affords the opportunity of a broad science curriculum in the context of a broad overall school curriculum, and it provides a basis for further and advanced level study in biology, chemistry and physics. Many were happy with this programme, particularly principals and science teachers in non-selective schools. There were also some grammar schools that had moved to this approach prior to the introduction of Science at Key Stage 4 and, having found their A level results had not suffered in consequence, were satisfied with double science as their maximum provision. Many teachers, however, particularly those in selective schools, were anxious about the adequacy of double award as a preparation for advanced study in the separate sciences and about the difficulties of meeting the needs of Year 13 students from different science backgrounds within the one class. Some pupils in both the interview and the questionnaire sample reported that they lacked confidence in proceeding to A level study in the separate sciences from the double science programme or that they felt poorly prepared for such A level study in comparison with those who had taken the triple science programme.

The important question of whether students are disadvantaged, in terms of eventual A level performance, by having taken a double science programme at Key Stage 4 cannot be answered through this survey since the first cohort of such pupils had not completed their course. Furthermore, it would be unwise to form a final judgement on the matter solely on the basis of the first cohort through the system; many teachers were tackling this issue on this scale for the first time and so were developing support strategies as they proceeded rather than availing of those already in place. Additionally, the alignment of double award syllabuses with A level syllabuses is reported to have been improved in the recent revision of the GCSE. Thus early outcomes may not be representative of future possibilities. Nonetheless, this is a matter which demands to be monitored closely.

Many schools found it difficult to decide which science courses to offer. Some of these difficulties sprang from tensions inherent in the Education Reform package itself. In particular, the market principle of the school responding to parental wishes sat very uneasily alongside the educational principle of the school providing a broad, balanced science curriculum within a broad balanced overall curriculum at Key Stage 4. At times the pressure brought to bear was sufficient to force schools to make provision which they would otherwise have considered inappropriate.

For the 30 survey schools in the study, principals' preferred provision for Science at Key Stage 4 is shown in Table 3 and that of heads of science in Table 4.

Table 3 A comparison of principals' preferred provision for Science at Key Stage 4, in 1993/4 and 1995/6

	1993/4 No of principals			1995/6 No of principals		
Provision	**Non-selective**	**Selective**	**Total**	**Non-selective**	**Selective**	**Total**
Balanced Science	18	4	22	20	3	23
Choice of 2 out of 3 separate sciences	0	3	3	0	4	4
Choice among the separate sciences or balanced science	0	1	1	0	2	2
Choice among the separate sciences	2	2	4	0	1	1

Table 4 A comparison of heads of science preferred provision for Science at Key Stage 4, in 1993/4 and 1995/6

	1993/4 No of heads of science			1995/6 No of heads of science		
Provision	**Non-selective**	**Selective**	**Total**	**Non-selective**	**Selective**	**Total**
Balanced Science	13	3	16	17	3	20
Choice of 2 out of 3 separate sciences	0	2	2	0	3	3
Choice among the separate sciences or balanced science	0	0	0	3	2	5
Choice among the separate sciences	7	5	12	0	2	2

There were also problems in relation to teaching and learning in Science at Key Stage 4. Its introduction has been associated with a significant reduction in the amount of practical work done by pupils, particularly, but by no means exclusively, for those following the double science programme. This has been accompanied by a corresponding increase in the relative time devoted to note-taking. Science for some pupils has become characterised by listening and copywriting rather than by discussing and doing.

Unfortunately, Attainment Target 1 was initially formulated in such a manner that it impeded rather than promoted good practice in this important aspect of science. That said, some pupils are afforded too few opportunities to develop their procedural understanding alongside their

conceptual understanding, that is, to advance in Attainment Target 1 to the same degree as in other attainment targets.

A number of heads of science considered that the double award syllabuses were over-burdened with content and consequently difficult to teach effectively.

Evaluating provision against the Programmes of Study for Key Stage 4 indicates that those aspects contained in its preamble, such as 'Communication', the 'Nature of Science' and the 'Application of Science' attracted less attention than might have been hoped for. Though some work is being done, co-ordination across the sciences is often weak. In addition, the findings of the survey would suggest that the impact of those educational (cross-curricular) themes which were not expressly incorporated within the syllabus and assessed through coursework or through written examinations has been, with some impressive exceptions, relatively minor. The contribution which communication and information technologies can make to science education has yet to be exploited to the full. The promotion of learning skills, including independent learning and library-based learning, is not always accorded its proper place in the secondary science curriculum. When it is included in Key Stage 3, continuity and progression is not always assured in Key Stage 4.

All schools have drawn up statements of aims, either for science or for the separate sciences. There is a tendency, however, for these to drift out of focus and they are rarely used, for example, to evaluate provision or to review practice.

Though the majority of young people in the survey schools found Science at Key Stage 4 to be interesting, accessible and relevant to their daily lives, there was a reduction in the level of interest from that expressed in relation to Science at Key Stage 3. Furthermore, pupils' responses varied from discipline to discipline with chemistry being perceived as particularly difficult and obscure by a number of respondents. Where pupils did not find science interesting, it was because it was considered too demanding, too rushed, unrelated to daily life or because there was little variety in their classroom experience. In particular, many commented on the lack of practical work and on the excessive copying of notes. A few did not find science interesting because they had been required to study a particular discipline against their will.

Where pupils did not find science easy, their problems were most likely to arise in relation to terminology in biology, to formulae and equations in chemistry and to calculations in physics.

It was evident from the survey that some successful work was being done to relate science to the everyday experiences of young people. Most viewed the subject as relevant and many could recount situations where they had availed of their science knowledge or skill in their daily lives, though disappointingly, the number who did so decreased from Key Stage 3 to Key Stage 4 and the patterns of use could scarcely be described as sophisticated. There were, however, some who saw no connection and made no connection between school science and their own concerns.

Though the number of students taking post-16 courses in sciences increased with more boys taking biology and more girls physics, the uptake, overall, of these subjects remains different for boys and girls. There was also evidence that, when pupils transferred to grammar schools at 16+ they were less likely to study science than other subjects.

The major factor which discouraged young people from pursuing science post-16 was that they perceived it to be more difficult than other subjects. It was widely believed that one could only do A level chemistry, and particularly A level physics, if one was very able. The second most common reason for discontinuing science post-16 was a lack of interest in the subject. However, around one-tenth of those who dropped science indicated that they *were* interested in the subject but had dropped it for other reasons, including the fact that it was easier to score good grades in other subjects. In this context, too, some appealed for a broader base to

A level study. It is disappointing that some young people opted out of science because they regarded it as impersonal or unfulfilling for those of a creative mind.

The Science at Key Stage 4 Survey was conducted at an early stage in the implementation of a new curriculum and assessment scheme and at a time of rapid and radical change in education. Such circumstances combine to make least likely to happen those very processes which most need to happen, namely, reflection on the rationale that underpins the inclusion of science in the curriculum of every pupil at Key Stage 4 and, in the light of this, a review of the aims, practices and outcomes of science teaching at this level. Over the past three years, however, most teachers' time has been taken up coming to terms with new programmes, new syllabuses, new coursework, new assessment schemes and even new audiences. All this has left little room for reflection, review and informed debate.

There is a pressing need now to revive discussion about the fundamental purposes of Science at Key Stage 4 and how these can be realised in practice. Echoing that aim for science education espoused by the majority of teachers in this survey, how best can we equip all our young people with knowledge and skills relevant to life in a society increasingly shaped by science and technology? How best can we then build on this to prepare some pupils also for post-16 study in sciences? How best can this be done without unduly restricting pupils' experience in other areas of study? Evidence from this survey suggests that such discussion has often been supplanted by a narrower debate focusing only on the appropriateness, or otherwise, of double award as a preparation for A level study in the separate sciences. Indeed there is a very real danger of Science at Key Stage 4 being judged on these grounds alone. In the short term, a careful consideration of all these issues, within the context of the current programmes of study, may well serve to address some of the concerns summarised above. The next few years have been advanced as a period of consolidation and reflection. This would give time for the new GCSE syllabuses to be evaluated; it would grant an opportunity to apply lessons learned from the CCEA transition to A level project; it would allow an appraisal of the results of future examinations in GNVQ science and in GCE A level biology, chemistry and physics; it would permit a clearer picture to emerge of the direction of developments arising from the Dearing, and other, reviews of qualifications, 16-19. Importantly, it would provide an interval relatively free from change in which to debate the key issues of why we teach Science at Key Stage 4 and what this implies for curriculum and approach.

In the longer term, however, this process of review may well point up the need for a more fundamental reform of the science curriculum for 14-19 year olds. Though Science at Key Stage 4 has achieved much, there are problems with the existing courses which have no simple solutions. The threefold provision is very complex. It is not yet clear, because it has not yet received sufficient consideration, whether the Programmes of Study provide the best that can be provided to prepare young people for life in a society shaped by science and technology. There are also distinct difficulties associated with each of the three pathways through Science at Key Stage 4. In Northern Ireland, almost half of our young people follow the single science programme from which there is no clear progression to post-16 study in the subject. In order for the double science programme to form a base for A levels in biology, chemistry or physics, it is content heavy. For the first post-Reform GCSE syllabuses, at least, this made for a relentless pace of teaching and contributed to a narrowing of learning experiences, including a reduction in practical work. Furthermore, transition from these courses to the recognisably difficult advanced courses in the separate sciences was reported to have caused problems in some, though not all, schools. Finally, the triple science programme curtails considerably the opportunities for a broad curricular experience. It may be that the current arrangements are the best compromise we can achieve between all those competing considerations which characterise Science at Key Stage 4, but it seems unlikely that this is so.

Any future review should pursue, with equal vigour, the two-fold issues of how best we can equip all our young people with science knowledge and skills relevant in everyday life and how we can also equip those who will study the sciences post-16 with science knowledge and skills relevant to their needs. Both require to be accommodated in Science at Key Stage 4

and in such a way that pupils are encouraged not to cut themselves off, irrevocably, from future possibilities by decisions made at age 13/14. This is a challenging agenda, but one which should be addressed if we are to prepare appropriately the young people of Northern Ireland to take their place in the world of the twenty-first century.

4.1 Curriculum and Assessment

To allow for proper planning and preparation, it is important that all elements of a new course, including the approval of its syllabuses, assessment arrangements and appropriate in-service training, be in place well before its starting date.

Where Government policy sets in motion a change as significant as that of the introduction of Science at Key Stage 4, schools require more support to help them work through the associated issues with parents. The production of good quality material, including video material, to explain the rationale behind the reforms would be beneficial.

As concerned educators, heads of science need to see their subject, not in isolation, but in the context of their pupils' whole curricular experience.

In drawing up schemes of work for Science at Key Stage 4, teachers should be guided, not only by the GCSE syllabuses but also by the relevant Programme of Study and by the school's aims for science education.

There is a need for greater co-ordination across the teaching of biology, chemistry and physics in Science at Key Stage 4.

There is a case for sharing with pupils the school's aims for Science at Key Stage 4 and for highlighting its role, not only as a preparation for future courses and careers, but also as a preparation for everyday life in a society shaped increasingly by science and technology.

The percentage of pupils following single science programmes is undesirably high and should be monitored with a view to reducing the numbers involved.

The quality and uptake of pre-GCSE science courses at Key Stage 4, and the opportunities they create, should be kept under review.

Future revisions of GCSE Science: Double Award syllabuses should seek a better compromise between the need to have sufficient content to support further study and the need to have a course which can be taught effectively in the time available.

At present, the administration of modular examinations at Key Stage 4 is taxing for schools and for their science staff. Every effort should be made to ease this burden as far as practicable.

Schools should monitor the number of pupils who follow the triple science programme at Key Stage 4 but discontinue their studies in the subject, post-16.

A major challenge for examining bodies is the establishment of inter-group comparability and the comparability of grades derived from different tiers of the same examination and from different examinations. Regulatory and awarding bodies need to maintain their vigilance in this regard.

While continuing to present GCSE Science: Double Award results as a double grade, there is value in making available on request an indication of performance in biology, chemistry and physics.

There is a need to recognise, in presentations of performance data, that GCSE grades F and G represent hard-won achievement for some pupils and their teachers.

There is evidence from this survey that the uptake of the sciences and particularly the physical sciences, post-16, is depressed by pupils' perceptions of the difficulty of these subjects at advanced level relative to other subjects. Furthermore, examination equivalence research has shown that there are grounds for this impression. Future reviews of A level syllabuses and examining procedures should address this issue.

It is important that schools give careful consideration to the advice they offer in respect of the double science/triple science option choice at the end of Key Stage 3. There is evidence from this survey that, if the link between triple science and advanced study is stressed too strongly, it adversely affects the confidence of pupils with double science to proceed to A levels in the separate sciences.

The uptake of GCE advanced courses in physics by girls, though showing a slight increase for the first cohort of pupils through Science at Key Stage 4, continues to be low. The challenge remains, then, of making the subject more attractive to girls at this level and of enhancing their confidence to take their studies further.

There is a need for secondary schools and grammar schools to work together in encouraging pupils, who transfer from one to the other, to continue with their science studies and to support them as they make the transition.

Teachers require more support, in terms both of professional training and the provision of appropriate bridging materials, as they take students on from double science programmes to advanced level study in the separate sciences.

Teachers identified IT, special needs, coursework and the outworking of the new GCSE syllabuses in general as the main areas where they would benefit from further professional development through the provision of appropriate INSET.

For many aspects of the teaching of Science at Key Stage 4, it is possible to draw on a substantial body of high quality educational research which can improve classroom practice. This is not always the case, however. In particular, further research should be conducted into note-taking in science, mathematics in science and the promotion of conceptual and procedural understanding among less able pupils.

4.2 Teaching and Learning

If we are to engage their interest and enthusiasm, there is a need for many young people to encounter a greater range of learning experiences than at present in Science at Key Stage 4.

Approaches to note-taking should be sought which are less time-consuming, more likely to promote understanding and which develop pupils' capacity for independent learning.

There is a need for a greater emphasis on practical work in many Science at Key Stage 4 programmes. With time at a premium, however, clear learning objectives are needed for such activities.

Pupils should have more opportunity to develop their competence and confidence in planning, carrying out and reporting on science investigations.

Pupils should have more opportunity to develop their competence and confidence in the use of communication and information technologies in Science at Key Stage 4. Developments in some schools, however, are being held back by limited resources.

Pupils should have more opportunity to develop their competence and confidence to work independently in Science at Key Stage 4. To this end, more use should be made of school libraries to support pupils' learning. The provision of learning skills programmes, co-ordinated with whole school schemes but tailored specifically to work in science, is also important.

Pupils should have personal copies of appropriate textbooks for Science at Key Stage 4.

Homework is an important component of teaching and learning in science and ways to engage all pupils in a regular programme of appropriate activities should be sought.

Pupils considered two aspects of Science at Key Stage 4, namely formulae and equations in chemistry and calculations in physics, to be particularly difficult. Teaching approaches need to be found which make these important ideas more accessible.

Appropriately, in attempting to make the subject accessible to less able pupils, much attention has been given to issues of reading and writing in Science at Key Stages 3 and 4. While this work has proved very valuable, it is now time to widen the agenda to consider, more specifically, how conceptual and procedural understanding in science may be promoted.

There is a case for schools exploring the possibilities of a greater sharing of experience and expertise between science staff and special needs staff and for more co-operation in breaking down barriers to learning in science.

It is important that young people see science as relevant to themselves and to their community and these issues should be stressed in the teaching of Science at Key Stage 4. In particular, pupils' experience of chemistry needs to be characterised, to a greater extent than at present, by a recognition of its significance in everyday life.

Pupils should be made aware of past, but most particularly contemporary, examples of science research and development work in Ireland.

Pupils should have more opportunity for self-expression in science, through, for example, discussion, writing and presentations.

Pupils should have more opportunity to apply their science knowledge and skills in the solution of practical problems and in decision-making activities.

There is a need to convey a view of science as a creative activity.

Schools should develop and apply more systematic approaches to the monitoring and evaluation of the outcomes of learning for Science at Key Stage 4, in terms not only of examination success, but also of their statement of aims and the Programme of Study.

There is a pressing need to revive discussion about the fundamental purposes of Science at Key Stage 4 and how these can best be realised in practice. There is also a need to find effective means of sharing this consensus-building process with the wider community.

5. Methodology

For each of the three years of the Science at Key Stage 4 study every post-primary school was surveyed to determine the science courses which it provided at this level and the uptake of those courses by pupils, in total and by sex. In the academic year, 1995/6, the first in which Key Stage 4 pupils proceeded to post-16 study, respondents were also invited to indicate the numbers taking advanced level or GNVQ courses in the sciences, compared with those immediately before. In all, information was obtained from 225 schools in the first 2 years and from 226 schools in the final year of the project. This represents, in each case, a response rate of 100%.

A sample of 30 post-primary schools, 20 non-selective and 10 selective, was drawn randomly and each institution was visited to invite the principal and head of science to become involved in the study. In these survey schools, over the three years of the project, semi-structured interviews were conducted with the major stakeholders in the Science at Key Stage 4 programmes, namely the principal, the head of science, the head of careers and, crucially, a sample of pupils. Typically, the interviews were arranged on a "pre-course, post-course" basis. Participants were first interviewed at or near the beginning of their experience of Key Stage 4. Subsequently, they were interviewed again, either in the case of the 118 pupils in the survey, when they had nearly completed the course, or in the case of the principals and heads of department, when the full course had been taught and examined. In addition, questionnaires were administered to around 3,000 pupils in the survey schools to investigate their attitudes to science and their reasons for choosing particular science programmes.

6. The Project

The Science at Key Stage 4 Survey was funded by DENI and undertaken within the School of Education at Queen's University. The grant-holder was Ruth Jarman, who was assisted in the research by Liam McAleese and Barbara McConnell. The cost of the project was £92,891.

7. Full Report

'Science at Key Stage 4: Summary of Main Findings', DENI Research Report Series No 9, by Ruth Jarman, Liam McAleese and Barbara McConnell, is available free of charge from DENI.

This paper is a summary of the research report, and as such, any views it contains are not necessarily those of DENI.

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