

NORTH LANARKSHIRE COUNCIL

REPORT

To: Education Committee	Subject Assessment of Achievement Programme (AAP) – Fifth Survey of Science (1999)
From: Director of Education	
Date: March 2001	
Ref: DS/KM	

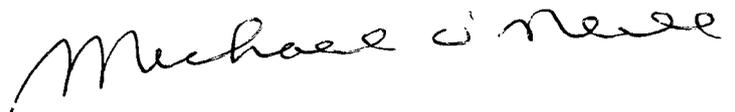
Purpose of Report

To inform members of the results of the national Assessment for Achievement Programme in Science (1999) and of the actions initiated by the education department to address the issues raised.

Recommendations

The education committee is asked:

- (i) to note the contents of this report



Members wishing any further information should contact:

Michael O'Neill, Director of Education on 01236 812336
Dan Sweeney, Head of Quality & Support Services on 01236 812291

North Lanarkshire Education Department

Assessment of Achievement Programme (AAP)

Fifth Survey of Science 1999

Report by Director

1. Background

- 1.1 The Scottish Executive Education Department (SEED) began a continuing programme of national surveys into the achievements of Scottish pupils in 1982. Since 1989 a three year cycle has been established which examines achievement in English, mathematics and science. In science the surveys were carried out in 1987, 1990, 1993 and 1996, with the current survey being conducted in 1999.
- 1.2 The main purpose of each survey was to describe the achievements of pupils in Scottish schools at three stages of their education; P4, P7 and S2, approximately covering ages 8-9, 11-12 and 13-14 respectively. Thus the target 5-14 guidelines were B, D and E respectively.
- 1.3 Besides description of performance, an important objective is comparison: between adjacent stages; over the period of time between surveys; and between the performance of boys and girls at each stage. Such information is valuable for monitoring any changes in standards over time and for providing evidence of progression.
- 1.4 The 1999 science survey began in September 1998 with the modification of previous assessment materials and the development of new material. These materials were trialled and modified as required, before being produced in their final form, with the testing taking place during May 1999.
- 1.5 The written assessment material was based on tasks involving knowledge and understanding or skills. For each stage, pupils were set tasks covering all of the attainment outcomes (as described in the National Guidelines: Environmental Studies 5-14) both at the stage band at which they were currently working and at the stage band immediately prior to that. This structure allowed progression in knowledge and understanding from stage to stage to be investigated.
- 1.6 The survey also involved a practical assessment taken by just under a third of all of the pupils in the survey, together with a school questionnaire and pupil questionnaire.
- 1.7 The planned number of schools in the survey was 195 at each of the primary stages and 130 at the secondary stage, with 20 pupils per school assessed at P4 and P7 and 30 at S2.

2. Results and key findings of the 1999 science survey

- 2.1 Performance in relation to 5-14 target levels. With respect to knowledge and understanding and skills the results of the survey showed that:
 - at P4, a majority of pupils had attained Level B or better in knowledge and understanding (68% of pupils) and in skills (63%)
 - at P7, a majority of pupils had attained Level D or better in knowledge and understanding (64%) but less than half had attained Level D in skills (41%)

- at S2, a majority of pupils had attained Level E in knowledge and understanding (51%) but just under half had attained Level E in skills (49%)

2.2 Performance by gender.

In this survey there were no significant differences overall between the performances of boys and girls in knowledge and understanding. If the separate attainment outcomes are considered, girls performed better in Understanding Living Things and the Processes of Life, while boys performed better in Understanding Energy and Forces and Understanding Earth and Space.

There were no significant differences in the percentages of boys and girls attaining the target levels in skills, although in terms of the mean scores in skill based tasks, girls significantly outperformed boys.

2.3 Performance over stages

A common set of tasks measuring knowledge and understanding of the key features in stage band P4-P6 was given to P4, P7 and S2. A further set of common tasks measuring knowledge and understanding of the key features of stage band P7-S2 was tackled by P7 and S2. Consequently it was possible to compare the performance in knowledge and understanding of older pupils with that of younger ones. There were no common tasks in skills so no comparison could be made.

The survey offered clear evidence that pupils' performance in scientific knowledge and understanding improved as they progressed from P4 to P7 and from P7 to S2. Whether the rate of improvement was acceptable remains a matter for debate.

2.4 Performance over time

The results of the 1999 survey were compared with the results of the 1993 and 1996 surveys in order to find out if performance was improving or not. The conclusions drawn relate only to the performance on those tasks. The results of the survey show that:

- at P4, there has been a significant improvement in performance in knowledge and understanding since 1993 although performance has only improved slightly since 1996. In terms of skills there has been a significant improvement compared with 1993 and 1996.
- at P7, while there has been no significant improvement in knowledge and understanding since either 1993 or 1996, there has been a decline in performance with respect to skills.
- at S2, while there has been a significant improvement in performance in knowledge and understanding since 1996, performance is still significantly below that of 1993. Likewise there has been a decline in pupil performance in skills compared with both 1996 and 1993.

2.5 Practical Assessment

The science practical skills of a sub-set of the sample of pupils were assessed using 27 short practical tasks. With one exception, the tasks were identical to those used in the 1996 survey. A comparison could therefore be made with performance in the 1996 survey. The practical assessment was used to measure performance with respect to gender and to measure performance over time. The results indicated that performance at the P4, P7 and S2 stages in the 1999 survey was almost identical with the performance of the equivalent stages in the 1996 survey. From the 1999 survey, of the three stages assessed, only at P7 was there a statistically significant difference in performance between boys and girls, with girls outperforming boys.

2.6 Responses to questionnaires

The following key conclusions emerged from the questionnaires returned by staff and pupils.

- Most schools were working on the implementation of 5-14 science
- More primary schools were teaching science as a separate subject than in 1996

- In defining what pupils should learn in science, both primary and secondary schools gave more attention to knowledge and understanding than skills
- Primary teachers perceived a lack of confidence and experience amongst staff to be the main obstacle to teaching science in their schools
- Very few schools or teachers grouped pupils by ability for their teaching of science
- Computers and their local environment were not widely used as resources in science
- Procedures for assessing and recording pupils' attainment in science were poorly developed in primary schools. Only a minority of primary and secondary schools were using 5-14 levels to report on pupils' attainment in science.
- Primary-secondary liaison in science had improved since 1996. However, only a minority of secondary schools had developed a joint programme of science with their associated primary schools.
- From an early stage, boys and girls displayed clear preferences for physics-based and biology-based topics respectively.
- Although girls' overall performance in science equalled that of boys, girls appeared to have lower self-esteem in science than boys.

3. Issues raised by survey

3.1 Standards

- 3.1 At none of the three stages assessed did "most" pupils (i.e. 75%) attain the appropriate target level. However, there were indications that the introduction of environmental studies 5-14 has significantly improved the science performance of pupils at P4.

Improvements in performance are not being seen at P7 and some more attention may need to be paid to developing more challenging science programmes for the upper primary years.

Although there were signs that the emphasis on raising attainment at S1/S2 might be having an effect, the evidence is not wholly conclusive. At present, the percentage of S2 pupils reaching Level E in both skills and knowledge and understanding is too low. Possible reasons for poor performance at S2 include low expectations of some pupils, a perceived lack of relevance in S1/S2 science course and inappropriate teaching methodologies.

3.2 Learning and teaching

While it appeared that almost all schools had fully implemented or were working on implementation of the science component of the national guidelines for environmental studies 5-14, more than a quarter of primary schools still had no agreed science programme.

The view amongst primary teachers was that lack of expertise in science was still proving to be the major obstacle to raising attainment in pupils. Some form of sustained staff development in science primary teachers would appear to be necessary if science teaching is to improve, especially in the upper primary.

As pupils are seldom grouped by ability when doing science, the question arises as to how teachers provide effectively for pupils' varying needs, including those of able pupils.

While experimental work proved popular, more opportunities for planning experiments and

developing skills such as recording and measuring, should be provided.

Pupils' experience of ICT in science is infrequent, particularly in S2. Opportunities should be created so that pupils may experience the use of ICT in appropriate science learning contexts.

More account should be taken of continuity and progression in learning science. Many secondary schools still appear to be adopting a "fresh start" approach to science in S1 rather than building on pupils' prior learning and attainment in primary schools. Primary schools should ensure that a topic-based approach does not lead to discontinuity in pupils' learning of science.

It is anticipated that the recent review of environmental studies 5-14 and the introduction of Level F and its more demanding content, will make S1/S2 science courses more demanding. This, combined with some innovative methodologies in science teaching, would, it is hoped, result in improved S2 performance in future surveys.

4. Actions taken by North Lanarkshire Education Department to address findings

4.1 While the AAP 1999 science survey highlights a number of issues regarding the raising of standards and performance in science, many of the concerns have already been addressed within North Lanarkshire.

4.2 The primary science programme which was formally launched in October 1999 was developed to overcome many of the concerns previously raised and underlined again in the recent AAP survey. Ostensibly, the North Lanarkshire primary science programme, based on 16 science topics specifically commissioned and written by a team of the authority's primary and secondary teaching staff, set out to tackle the following issues.

4.3 Recognising the need to provide continuity and progression in learning science from P1 through to S2, a programme, based on the national guidelines for environmental studies 5-14, was devised. It was anticipated that the best method of delivery would be teaching science as a separate subject in primary schools (borne out by the AAPs findings that the number of schools doing so has trebled since 1996) and subsequently the 16 teaching and learning packs adopted that focus.

Each of these packs contain a number of relevant science activities intended to improve not only knowledge and understanding but also the skills associated with science. Indeed, the practical investigations which form a crucial component of each topic, develop skills such as planning experiments, measuring and recording data, which are not only outlined within the 5-14 guidelines but are also key skills within Standard Grade and Higher Still sciences.

4.4 While the content from P1-P6 was largely determined by the national guidelines, the P7 programme was agreed after consultation, and subsequently a set of three P7 topics was produced for all schools to adopt.

In so doing, some of the national concerns including: developing a more challenging programme for P7; providing a joint programme for primary-secondary liaison; and ensuring that in S1 cognisance would be taken of prior learning in science, were overcome.

4.5 The teaching and learning packs, in conjunction with a comprehensive primary science inservice

programme which was initiated in 1997, provided primary staff with the necessary scientific information, access to resources and appropriate methodologies, with the intention of improving their lack of expertise and confidence in science.

- 4.6 Although it is hoped that the implementation of a formal primary science programme would have an effect on performance in S1/S2 in the longer term, the more immediate plans to tackle the recognised underachievement in the lower secondary have been hindered due to the review of the 5-14 guidelines. The recent publication and distribution of the revised 5-14 Environmental Studies:Science documents, with the inclusion of Level F, will lead to a more demanding course for S1 and especially S2.
- 4.7 The authority's plans to develop teaching and learning materials to complete their own 5-14 programme and take cognisance of new content, have been delayed due to the national review. In the intervening period SEED has recognised the need to produce a national 5-14 science course and plans are underway to develop such a course. Recognition has been made of North Lanarkshire's initiative in science with SEED not only acknowledging the programme nationally but wishing to use our expertise in contributing towards the creation of a national course. While the intended launch of such a course in 2003 might be superfluous to the needs of primary schools in North Lanarkshire, the availability of a long overdue national course for S1/S2 would to a greater extent resolve the issues raised by the AAP survey.
- 4.8 While it might be prudent to await the publication of a national course with respect to S1/S2, steps have been taken to deal with some of the issues in the interim. Still awaiting the distribution of national assessment materials for knowledge and understanding, the authority has again taken the initiative in developing and producing a pack and guidelines for the assessment of practical skills. Similarly, inservice has been offered to emphasise the importance of the investigative approach to practical science and ultimately the assessment of these skills.
- 4.9 Since the distribution of the new guidelines, an audit of the content currently being delivered by virtue of the primary science programme and those courses most commonly used in S1/S2 has been conducted. With the exception of one or two attainment targets within each of the three attainment outcomes which have still to be addressed, the authority is confident that the knowledge and understanding content with respect to 5-14 is well covered in North Lanarkshire schools.
- 4.10 In conjunction with other initiatives, including the purchase of ICT interfacing equipment for all secondary schools, (with the appropriate inservice for all principal teachers of science), in an attempt to create more relevant ICT opportunities for S1/S2, these developments in North Lanarkshire have made a considerable impact in addressing the issues raised by the AAP science survey 1999.

5. Recommendations

5.1 The education committee is asked:

- (i) to note the contents of the report.