Staffing and Curricular Provision in National Curriculum Information Technology

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☐ Background

The introduction of National Curriculum Technology has provided schools with a framework for Information Technology experience across the whole curriculum. Teachers of each core and foundation subject are encouraged to identify and make an appropriate provision towards the strands of Profile Component 2 (Attainment Target 5) of the Technology Order. The relationship between Design and Technology (Profile Component 1) and Profile Component 2 is of particular interest to many, not only because of its shared existence in the same ring binder, but also because of existing practices, in the use of computers within Art and Design, Business Studies, CDT and Home Economics.

This paper reports on one aspect of part of a one year UFC-funded project to investigate the INSET needs of Design and Technology teachers in the National Curriculum. The data collection methods used were a questionnaire mailed to all secondary institutions in a Local Education Authority followed up with semi-structured interviews in selected institutions. The aspect covered here reports on the data relating to Information Technology within Design and Technology collected from the questionnaire and presents an interpretation and discussion of the findings.

☐ Research Method

The questionnaire, 'INSET needs for design and Technology in the National Curriculum', was mailed in the Spring Term of '91 to 96 secondary institutions in the Local Education Authority for completion by respective heads of department or faculty. This time of year was chosen because of the problems associated with return rates from December surveys [1], the time taken in constructing the questionnaire and to allow institutions a complete term of National Curriculum Technology delivery.

The survey questions were based on the National Curriculum documents available to schools, namely 'Technology in the National Curriculum' [2] and the Non-Statutory Guidance [3], and were focussed on organisation, curriculum, planning and professional development. Of the twenty-seven questions in the questionnaire nine were of relevance to Information Technology; it is the findings from these questions which are reported here (Appendix I). The remaining eighteen questions, relating specifically to Design and Technology, are not covered by this paper but have been reported separately [4].

Questions were designed to be completed quickly; used an uncomplicated language structure; and avoided the use of negatives. The final version of this questionnaire was word processed to obtain the best layout and field trialled with a sample of institutions to check for clarity of expression and ease of completion [5].

The questions were structured in one of three ways:

1 to obtain specific numerical data, often involving the completion of a matrix;

2 To invite open-ended comment;

3 to identify existing intentions/practice and/or planned provision on a range of attributes relating to a theme, with a space for other comments.

Careful consideration was given to how the data would be collated and analysed; the intention was to store, process and retrieve selective or summative information by using an appropriate information system. The system selected was a programmable relational database shell running on an IBM Compatible Personal Computer. The database package used was the Archive database, part of the PSION PC-Four suite [6], since this package allows the creation of specific applications involving multiple files which can be linked together by creating high level language routines [7]. Furthermore, at a later date, complete files can be exported to other applications; examples would be other databases, spreadsheets or graph drawing packages. It is beyond the scope of this paper to report at this stage on the techniques involved in using a relational database; it is intended to produce a separate publication on this topic at a later date.

The data obtained from the 3 types of question outlined above were stored, using separate records for each institution, as:

1 unmodified numerical data from which ratios, counts, limits, totals and percentages could be obtained;

2 a literal string, ie. no changes or coding made to the response. The original intention was to code the responses, but their range was so wide as to render this impractical. The implication of this was that information could only be retrieved by searching for text occurrences, browsing the relevant file or visually scanning the printed output;

3 a comma separated string, using those items which had been ringed, eg. "1, 3, 4, 7". Interrogation routines were then written to calculate numbers, percentages and frequencies of particular occurrences.

In practice the information system worked well in that rapid data analysis could be performed at any stage of the enquiry, with similar rapid re-analysis when late returns had been processed.

The clear advantages here are that:

1 a check can be quickly made of the validity and statistical significance of the sample size of, say, between 40 and 50 returns;

2 preliminary hypotheses can be formulated and checked as the sample size increases;

3 the cut-off date can be extended, allowing a greater sample size to be achieved, since data analysis is not dependant on all returns;

4 the time required to write the analysis routines was compensated for by the speed of analysis by the system.

The system highlighted several problem areas within the design of the questionnaire. In particular, doubt was cast on the integrity of the data collected relating to planned provision for a number of questions. Questions often failed to differentiate between whether 'existing' practice was 'planned' to continue or whether 'planned' provision was because of lack of 'existing' practice (ie, many respondents ringed an attribute as 'existing' but did not ring the same attribute as 'planned'). For this reason this paper can only report with empirical validity on what was claimed as existing practice (and was it practice, as distinct from what was intended?) rather than planned provision [8].

LEA Organisation

The final sample size used for the analysis of data was 50 percent of the mailed questionnaires, or 48 institutions. Table 1 shows by school designation (High, Secondary, Upper, Special); age range, field size, response rate, and numbers on roll.

The LEA contains two organisational models for secondary education:

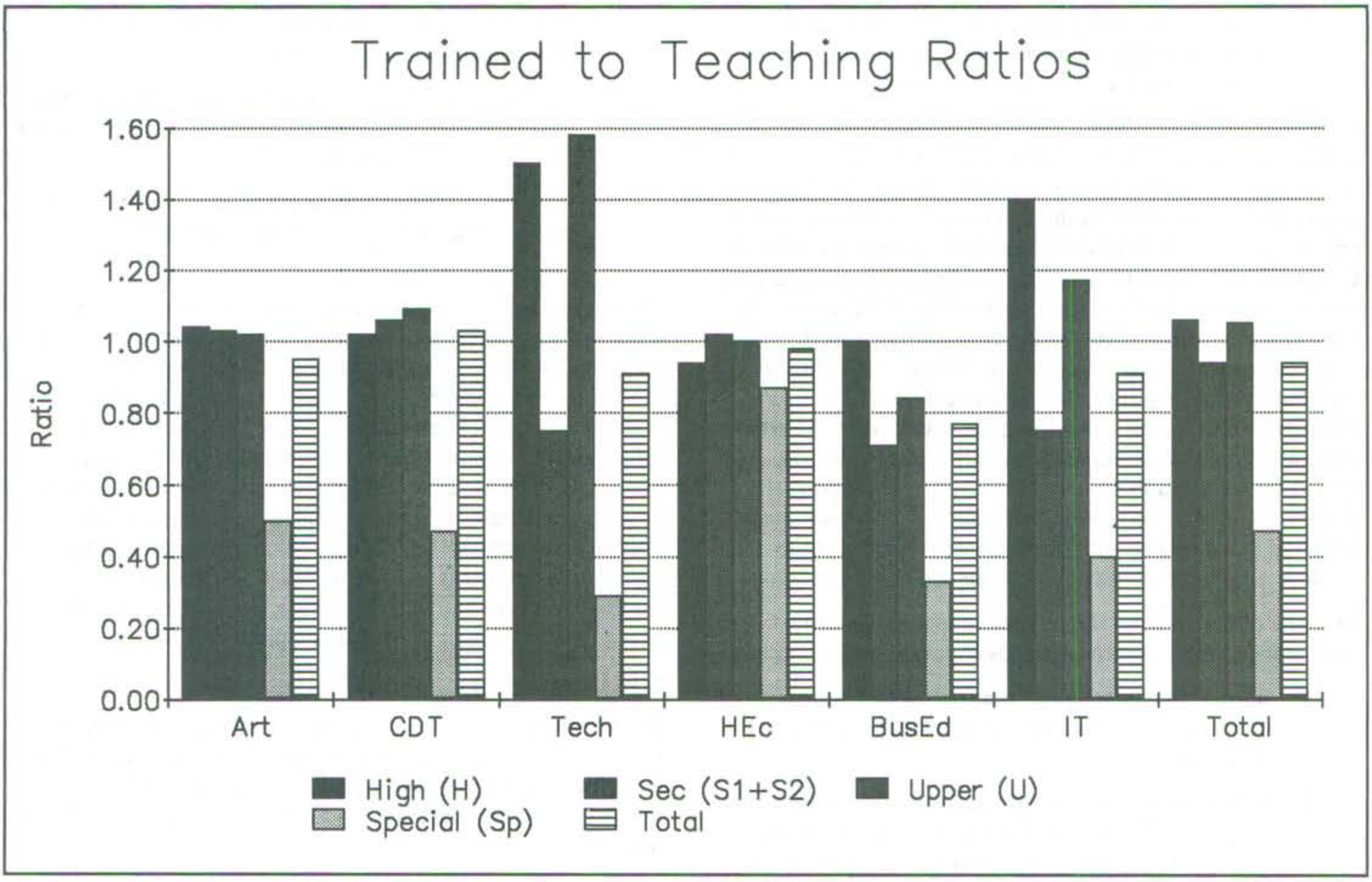
A Transfer at age 14, year 10, from High to Upper school. The implication for National Curriculum delivery is that transfer occurs at the end of Key Stage 3 with Upper schools only being concerned with classroom delivery at Key Stage 4.

B Transfer at age 11, year 7, from Primary to Secondary school. The implication here is that Secondary schools are concerned with delivery at both Key Stages 3 and 4.

The sample size represents both models in equal numbers of school designations (14 High, 13 Upper and 14 Secondary schools), therefore the two models may be compared for analysis and discussion.

Table 1: Proportion of responses and numbers on roll in schools surveyed

	Age Range	Field	Response No.	%	NOR in survey No.	%
High	10/11-14	36	14	39	7638	23
Secondary	11-16/18	28	14	50	11654	35
Upper	14-18	16	13	81	13482	41
Special	3/11-16/18	16	7	44	474	1
Total		96	48	50	33248	100



☐ Pupil Teacher Ratios

Questions 1 and 2 of the questionnaire (Appendix I) asked for the numbers of staff teaching and trained (or experienced) in Art and Design, Business Education, CDT, Home Economics, IT and Technology. The findings are represented in Figure 1 as a ratio of trained, or experienced, teachers to practising teachers in each discipline.

A ratio of less than 1 may suggest a deficiency of appropriate teachers whilst a ratio of greater than 1 may indicate a surplus or underuse of specialist teachers. The low ratio in all disciplines for Special Schools reflects on their necessarily low PTRs and their broader, yet specialised, curricular and pastoral skills training for teachers [4].

Taking the case of Information Technology teachers, the values for High (1.4) and Upper (1.17) schools may be accounted for by the use of IT specialists in a curriculum coordination role, a function encouraged in the Non-Statutory Guidance for IT [9]. In the Secondary schools surveyed the ratio of 0.75 might indicate a shortage of suitably trained or experienced teachers. This may not be the case - there may be a higher proportion of non-specialists making use of IT in the classroom. The implications may be that for the LEA organisational model A there may be an existing curriculum support structure for IT whereas in model B this could be conatrained by an inadequate number of appropriately trained or experienced personnel. This hypothesis is not entirely supported by closer examination of the data for pupil teacher ratios (PTR) in Information Technology (Table 2), and poses a paradox related to staff distribution. However an idea of what constitutes a reasonable PTR needs to be explored first.

It is difficult to say precisely what a suitable PTR for Information Technology would be because of three delivery methods which may be operating either simultaneously or in isolation. IT may be part of the 'confederation' of subjects for Design and Technology, taught as a separate subject, or not taught at all but experienced across a wide range of subjects. In the first it may be a tool used within Design and in the second a vehicle for the acquisition of skills transferable to other subjects, in which case some form of curriculum support may exist.

If an institution is operating a curriculum support model then one trained or experienced teacher is required to act as coordinator; hence the PTR is N:1, where N is the number of pupils in the school. Across a whole LEA this value would be the average size of that school designation.

From Table 1, using the sample size for each school designation, values of N are 546, 832, and 1037 for High, Secondary and Upper schools respectively. Relating these figures to Table 2 ((A) Trained) it can be seen that in all but one case, values for PTR(a) and PTR(b) will theoretically allow a curriculum support model to operate. The exception is the value of 1091, twice the theoretical value, for PTR(a) in High Schools; there are 7 trained teachers employed in 5 of the 14 schools in the sample.

The observed values for Secondary schools again offer a paradox in that trained to teaching ratios may not be in favour of a curriculum support model, but PTRs suggest otherwise

Table 2: IT Pupil Teacher Ratios

A) Trained

	Teachers	Schools	PTR(a)	PTR(b)
High	7	5 (35%)	1091	436
Secondary	14	10 (71%)	832	615
Upper	28.5	12 (92%)	473	444
Special	4	3 (43%)	118	60

PTR(a) Calculations of IT teachers (trained): NOR of all schools of that type in sample.

PTR(b) Calculation of IT teachers (trained): NOR of schools in which those teachers employed.

B) Teaching

	Teachers	Schools	PTR(c)	PTR(d)
High	5	3 (21%)	1527	370
Secondary	18.5	11 (79%)	630	530
Upper	25.5	12 (92%)	529	489
Special	10	3 (43%)	47	16

PTR(c) Calculation of IT teachers (teaching): NOR of all schools of that type in sample.

PTR(d) Calculation of IT teachers (teaching): NOR of schools in which those teachers employed.

(PTR(a) is equal to, and PTR(b) is 0.74 of the theoretically proposed value). An adequate number of trained staff exists, with an even greater amount of non-specialists involved at classroom level. The factor which could restrain curriculum support, with PTRs so close to the theoretical value, is that specialists may already be operationally stretched through commitment to examination and vocational classes in computer studies. Compare this with the corresponding values in Upper schools where there is a makred difference in PTRs, favouring use of staff in both support and teaching capacities.

The theoretical calculation of PTRs for IT as part of a confederation of Design and Technology is more tentative, based on three assumptions:

i A PTR of 16:1 for Secondary schools (source: DES/TES data 1989/90);

ii The Design and Technology 'entitlement' is 10% whole curriculum time [10];

iii IT is one of five contributors.

Therefore, on these assumptions, a reasonable PTR for IT within Design and Technology would be 800:1 (16x10x5), similar to the value proposed for a curriculum support model.

The values, with the exception of one, for PTR(c) and PTR(d) in Table 2 ((B) Teaching) would suggest adequate staff levels for the delivery of IT within Design and Technology. The exception, 1527:1 for High schools, is again related to the anomaly produced by the trained to teaching ratio. Certainly the present state of affairs indicates that there is insufficient teaching staff to provide an IT input in Design and Technology into all High Schools; the situation is very different in the schools with both staff trained in, and delivering IT as part of the learning experience.

Table 3: IT Coordinator

	Existing (%)	Planned (%)
High	64	7
Secondary	79	0
Upper	92	0
Special	100	0
Total	81	2

☐ Coordination

Question 4 of the questionnaire (Appendix I) asked if there was a coordinator for Design and Technology, Technology, Economic and Industrial Understanding, Information Technology, or other. Table 3 shows the responses for Information Technology by school designation. For reasons outlined earlier in this paper only existing responsibilities will be discussed, though the data for planned provision illustrate the problems encountered with the research instrument.

The most significant finding is that all Special Schools in the survey had a coordinator, illustrating their commitment to a broad non-specialised curriculum. The responses for High, Secondary and Upper schools further reinforce the postulated relationship between a curriculum support model, PTRs and trained to teaching ratios. Upper schools are sufficiently staffed for a coordinator, whilst Secondary schools may be operationally stretched to free staff for the time required for curriculum coordination and many High Schools have a shortage of appropriate personnel.

☐ Delivery Strands

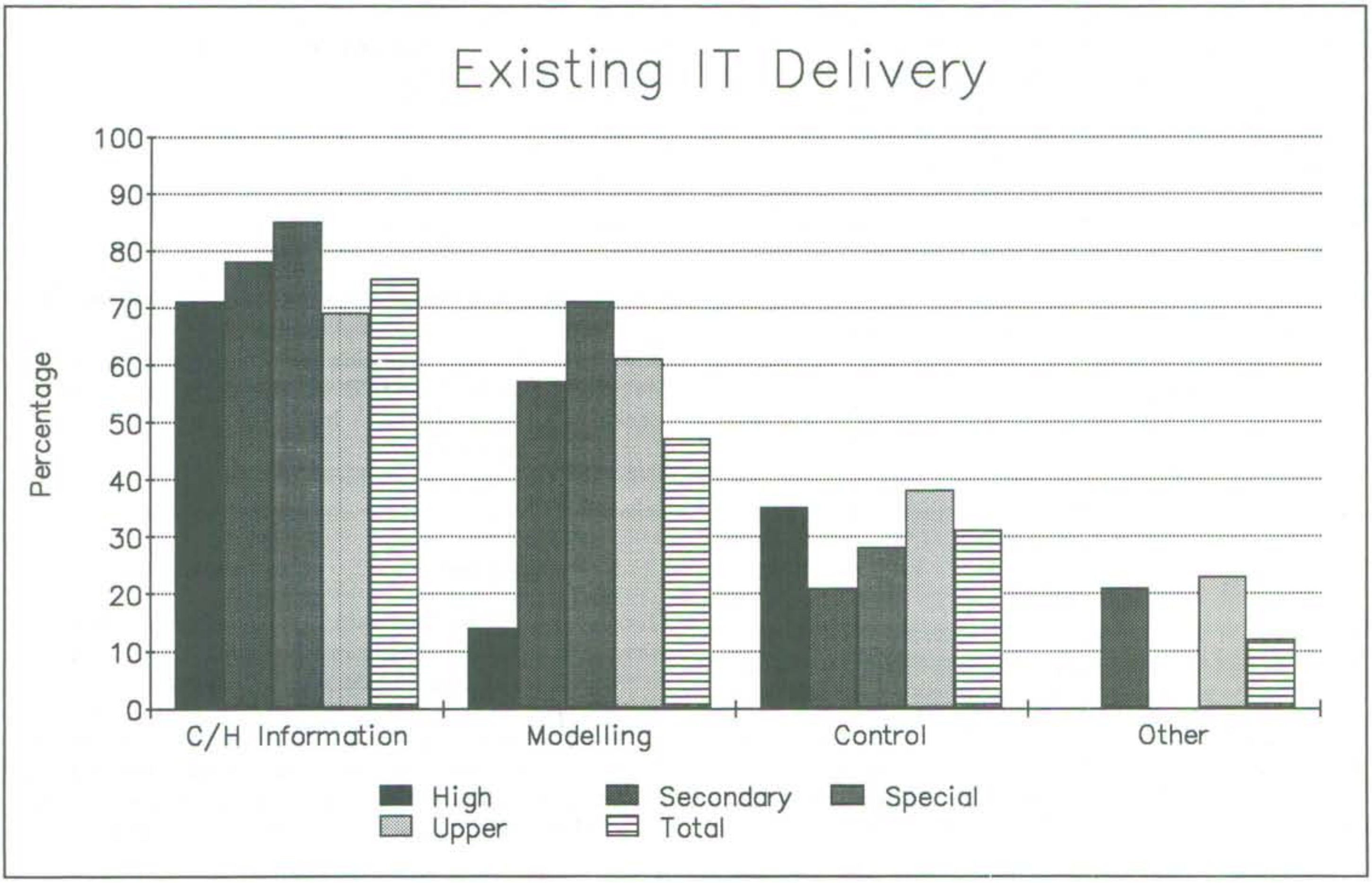
The delivery strands of IT, as outlined in AT5 [2], and delivery models [9] were reflected in question 11 of the questionnaire (Appendix I). This question asked which categories of IT in the National Curriculum are, and are planned to be, taught within Design and Technology. Figure 2 shows the responses for existing delivery, the corresponding data for planned delivery is not cited here for reasons outlined earlier in this paper. A further survey will be required to investigate if the weaknesses found in existing delivery have been addressed by development planning.

Two of the strands proposed by the NCC, modelling and control, are not prominent in the majority of schools. This is particularly surprising given that the former is considered to be a powerful tool for simulation and has strong links with Technology AT2 (Generating a Design) and that the latter of these two strands is traditionaly closer to Design and Technology than other subject areas.

The use of computer software for modelling real and imaginary situations figured prominently in Special schools. This may be because of its power as a stimulus for pupils to explore computer created microworlds [11]. However the same reasons should be equally valid in High schools where this strand was especially weak.

Communicating and handling information was strong in all the types of school in the sample, though it must be considered that this strength does not necessarily imply that the IT provision in Design and Technology is strong. These two strands may be strong across the whole curriculum and the deficiencies which could be best addressed through Design and Technology are indeed totally absent. At present the scanty data, from this survey, for planned provision does not suggest that the deficient strands will improve in the immediate future.

A few of the responses, in the comment space at the bottom of this question, indicated that there is some confusion about the 'jargon' in the Non-Statutory Guidance relating to the delivery strands. These comments usually gave a list of software packages, having left the earlier part of the question blank. Such responses were categorised, where possible, by the researchers and included in the data represented by Figure 2. This confusion underlies the findings discussed later where INSET for IT is seen as a priority.



☐ Planning for Design and Technology

Question 15 of the questionnaire (Appendix I) asked how many staff from various disciplines were involved in planning for Design and Technology. The responses were expressed as a percentage of those teachers in the respective subject areas. For IT staff the input into planning was High (80%), Secondary (62%), Special (100%), Upper (62%). The figures for Secondary and Upper are expectedly lower because planning, at the time of enquiry, was directed towards Key Stage 3 and their curriculum extends to Key Stage 4. The response from Special schools, again, shows the commitment to a broad-based non-specialised curriculum.

☐ Professional Development

Questions 21, 22, and 23 (Appendix I) asked for numerical data relating to how many teachers, from Art and Design, Business Education, CDT, Home Economics, IT, and Technology had read the Technology Order, read the Non-Statutory Guidance and had INSET specifically for Design and Technology. The responses, for IT teachers only, are expressed in Figure 3.

One year after publication of the NCC documents for Technology many IT teachers still had not seen them, with 70% having read the Technology Order, and 57% the Non-Statutory Guidance. The findings for INSET provision are highest in the High Schools (80%) but overall (37%).

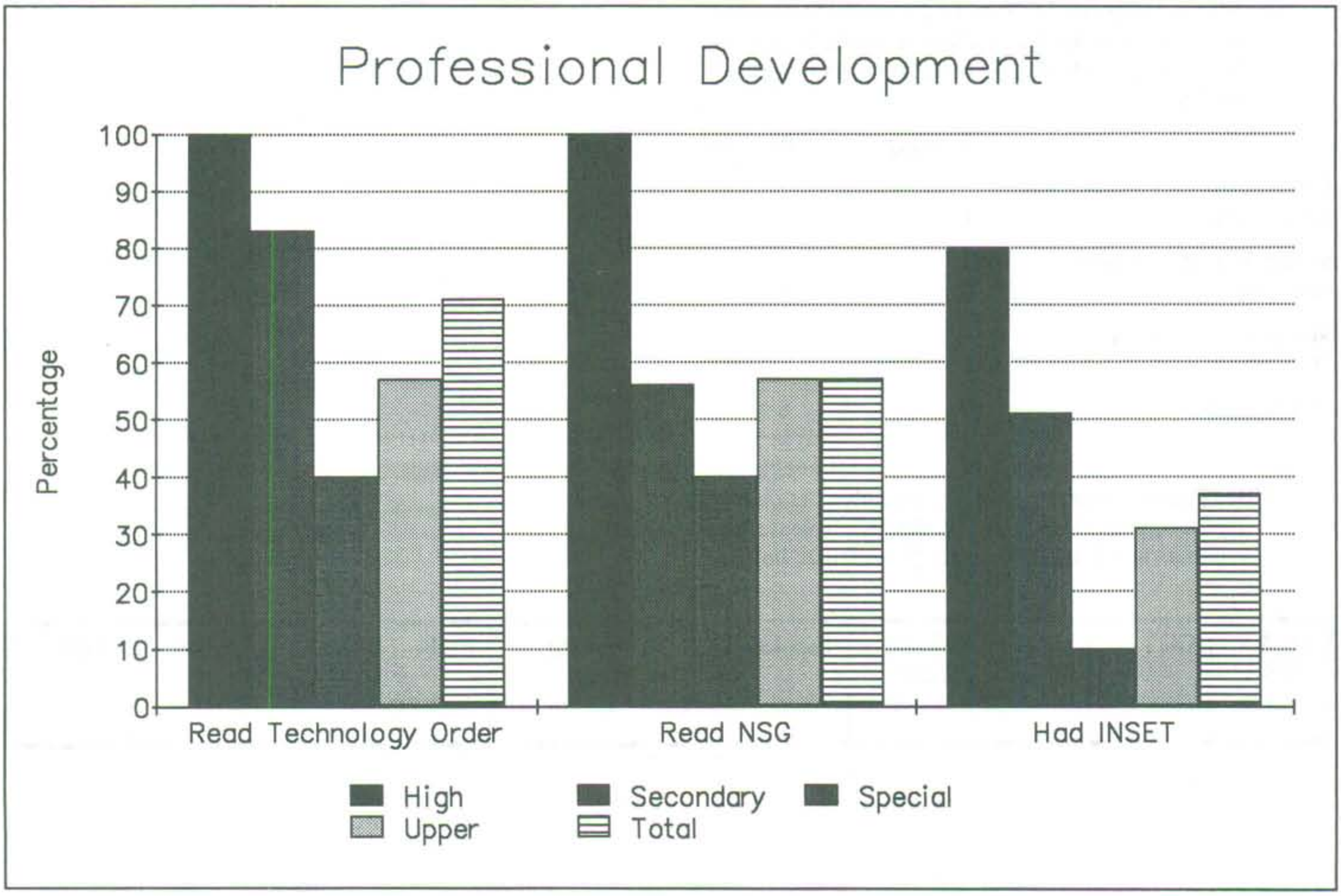
Not surprisingly, from the issues referenced for support by question 24 (Appendix I), INSET in IT was the fourth highest priority, mainly in the area of integration of teacher skills within the curriculum. The highest priority was time for planning the structure, management and implementation of an integrated approach, balancing schemes of work with programmes of study and attainment targets.

☐ Summary

Overall the findings from this initial survey indicate that schools are in a position to address the requirements for integration of Information Technology into Design and Technology and as a support structure for the whole curriculum. In general staffing levels are adequate across the sample schools in this survey. The delivery of the strands of IT was found to be biased towards communicating and handling information and away from modelling control.

There is an identified need for INSET, especially integration of teacher skills within the curriculum, and also in understanding the full requirements and interpretation of Attainment Target 5. At the time of this enquiry there was still an absence of agreement over the terminology used, but this should disappear with the passage of time.

Since this paper reports only on existing practice, taken from a survey twelve months ago, there is scope to repeat the survey in the same LEA or with the inclusion of other LEAs. This would provide a clearer picture of the level of development planning as schools react to National Curriculum requirements.



☐ APPENDIX I:

Questions Relating to Information Technology from the 'Inset Needs for Design and Technology in the National Curriculum' Questionnaire

	Art & Design	CDT	Tech	Home Econ	Bus Ed	IT	Total
1 Teaching							
2 Trained							

1 How many full-time equivalent staff are *teaching* in these subject areas?

2 How many staff are *trained,* or very experienced, in these areas?

4 Is there existing, or planned, a *co-ordinator* for: (please ring those numbers which apply)

	Existing	Planned
Design and Technology	1	6
Technology	2	7
Economic and Industrial Understanding	3	8
I.T.	4	9
Other (please state)	5	10

11 Which categories of IT in the National Curriculum are, and are planned to be, taught within Design and Technology? (please ring those numbers which apply)

	Existing	Planned
Communicating and Handling Information	1	5
Models of real/imaginary situations	2	6
Measurement and control of variables	3	7
Other (please state)	4	8

15 How many *members of staff* are involved in planning for Design and Technology in the NC? (please enter numbers below and state who 'Others' may be)

Art & DES	CDT	Tech	Home Econ	Bus Ed	IT	Eng	Math	Sci	Other	Total

21 How many teachers have read the Document, Technology in the National Curriculum, referred to by the 1990 Statutory Order?

22 How many teachers have read the NCC Non-Statutory Guidance for Design and Technology Capabiility?

23 How many teachers have had any INSET specifically for Design and Technology in the NC?

	Art & DES	CDT	Tech	Home Econ	Bus Ed	IT	Other	Total
21								
22								
23								

Please respond to questions 21-23 by indicating the number of teachers, where applicable, in the boxes provided in the table above.

24 Which *issues* of Technology in the NC are perceived as the highest priority?

☐ References

1 Hoinville, G and Jowell, R (1978) Survey Research Practice (Heinemann)

2 Technology in the National Curriculum, DES 1990

3 Non-Statutory Guidance: Design and Technology Capability, DES 1990

4 Doat, D R and Zanker, N (1991) 'Current practice and future needs in Design and Technology in the Secondary sector', Papers and Poster Abstracts of the Fourth National Conference in Design and Technology Educational and Curriculum Development

5 Cohen, L and Manion, L (1989) Research Methods in Education (Routledge)

6 PC-Four (1984) PC-Archive User Guide, PSION

7 Morris S, (1986) The Archive User's Reference Manual (Glentop)

8 Verma, K G and Beard, R M (1981) What is Educational Research? (Gower)

9 Non-Statutory Guidance: Information Technology Capability, DES 1990

10 Curriculum Guidance 3: The Whole Curriculum, NCC 1990

11 Papert, S (1980) Mindstorms: Children, Computers and Powerful Ideas (Harvester)