The Application of Number Experience

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Note
This research is based on data collected by University of Cambridge Local Examinations Syndicate for Oxford, Cambridge and RSA examinations (OCR).

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Abstract

Application of Number (AoN) is part of the Key Skills curriculum in General National Vocational Qualifications (GNVQs). AoN is a more practically based form of study which provides an interesting contrast with the more academically orientated GCSE mathematics. Key Skills are an increasingly influential part of both the 16 to 19 and the higher education sectors. However there is little documented information about the delivery of AoN in GNVQs.

In this paper, there are three lines of analysis: (1) how does AoN relate to GCSE mathematics (2) how is AoN delivered and (3) what are staff and students' experiences of related issues? To investigate these questions this paper draws on both quantitative and qualitative data. The results of a survey of centres offering GNVQs showed some parallels between the two, despite the qualitative difference in their styles and purpose. Indeed some students study both simultaneously. The survey also found five different ways in which AoN is delivered. These modes of delivery will be described. Semi-structured interviews with students and staff illustrate their experiences of these modes of delivery. Key issues arising from the interviews will be discussed.

1. Introduction

In 1993 General National Vocational Qualifications (GNVQs) were introduced into England, Wales and Northern Ireland. These new vocational qualifications were designed to develop "*general skills as well as ...specific working skills*" (White Paper: Education and Training for the 21st century). With this in mind Core[1] Skills were incorporated into the GNVQ assessment framework. Six Core Skill areas were identified; three were compulsory - *Communication; Application of Number and Information Technology* - and three were optional - *Working with Others, Improving Own Learning and Problem Solving.*

Although there has been a great deal of literature on Key (or Core) Skills, this has mainly investigated what skills can be classified as "Key" (e.g., Oates, 1991, Further Education Unit, 1993, Hyland, 1994), the importance and desirability of including transferable skills into the curriculum (e.g. Baker, 1989; Confederation of British Industry, 1989; National Curriculum Council, 1990, NCVQ, 1995, Dearing, 1996) and the competence of individuals in these areas (e.g. Murphy et al., 1997). There has been rather less written on how centres are actually managing the implementation of this initiative, (Oates, 1991; 1996; Wolf, 1995; 1997), and even less which focuses specifically on Application of Number, which almost from the start has been recognised as problematic (NCVQ, 1993).

Whilst both GCSE and GNVQ are 'general' education the two qualifications have different purposes, philosophies and assessment objectives. AoN in GNVQ provides an interesting contrast to GCSE mathematics. As there is little literature specifically about AoN there are few documented comparisons between AoN and GCSE mathematics.

This paper will follow three lines of analysis:-

- What organisational structures are used in the delivery of AoN;
- How these structures are being developed;
- What staff and students reactions are to these methods of organisation.

In the discussion section the models are compared and discussed. This discussion is **not** aiming to develop models of good practice or to make recommendations about how AoN should be structured. Rather we aim to explore what is happening and how staff and students have reacted.

[1] now Key

This paper should be read with two factors in mind:-

- both quantitative data and the preliminary analysis of qualitative data are used to discuss the relationship between AoN and GCSE mathematics, how AoN is delivered and staff and students' experiences of related issues. So it is possible that future reports of this project might show developments in the ideas that are presented at this stage;
- it is a summary of some of the key issues from a wider project, it is beyond the scope of this paper to describe the whole project in detail, only the points pertinent to the lines of analysis outlined above will be presented.

2. Methodology

A questionnaire was circulated at the end of the Summer 1998 term to a large number of centres (McAlpine, 1998). This was followed by interviews at a number of case study centres which were identified from their responses to the survey.

2.1 Survey of centres

The circulated questionnaire was developed by the first author in conjunction with a mathematics examination administrator and members of the development team.

2.1.1 Survey Questionnaire - Development of the Instrument

The questionnaire comprised 20 questions.

Questions 1 and 2	*provided background detail about the centre and its provision of GNVQs.*
Questions 3-7	*concerned the organisation and staffing of Application of Number*
Questions 8-16	*concerned the relationship between the provision of AoN and the Mathematics Department*
Question 17	*asked them which GCSE Mathematics syllabus they currently used*
Question 18 (a and b)	*asked them about their entry strategy for modular Mathematics GCSEs (if applicable)*
Question 19	*comprised a number of rating scales concerning attitudes towards modular exams*
Question 20	*invited any further comments.*

There was also an additional question which asked the respondents if they would be willing to participate in further research.

The questionnaire was designed to be as objective as possible, both to increase response rates and also for ease of analysis - only three questions (including Q20) were open ended, while a further two invited respondents to develop their answer. Other than the first question and the open ended questions respondents were asked to answer separately for the three levels of GNVQ.

A copy of the questionnaire is attached as Appendix 1.

2.2 Development of Models and Identification of Case Study Centres

On the basis of the centres' answers to questions 3, 5 and 11 of the survey questionnaire (see Appendix 1) as well as other general comments that they had made, they were sorted into different groups, each of which comprised a model. Five major models were identified. See Table 0.3 and Table 0.4. There were also a number of centres whose provision was more idiosyncratic or which had not provided enough information to identify them as one model or another. These were not used to identify the models. The researchers, together with a mathematics examination administrator identified the models. The researchers chose centres to represent each model as a case study.

It was decided that if possible the sample should include all of the types of centres which were delivering AoN, and where possible centres which were "typical of their model" should be chosen. Five centres were duly identified for further study.

The researchers and a mathematics examination administrator examined the questionnaire returns of the centres which had accepted. The main criterion for choosing a centre as a case study to represent a model were:-

- the "keenness" of the centre to participate - *to minimise rejection rates;*
- further details of provision given by the centre - *to ensure that it was typical of its model.*

The responses to the survey were then used to identify "models" of how centres were choosing to structure their Application of Number provision and five centres each typifying one of the identified models were chosen to form the case studies.

2.3 Conduct of Case Studies

2.3.1 Interviews with Centres

2.3.1.1 Development of the instruments

A number of key people had been identified as holding important, yet distinct perspectives on the issues that we wished to explore. These were:-

- Head of Mathematics department;
- Member of Mathematics department;
- Member of staff (not Mathematics department) who delivers GNVQ;
- Member of Senior Management Team (Curriculum Co-ordinator);
- Key Skills Co-ordinator;
- Student studying GCSE mathematics;
- Student studying (primarily) GNVQs, but not GCSE Mathematics.

Separate schedules focusing on different issues were developed for each role. Table 0.1 shows the issues which were focused on for participating staff and students.

Table 0.1 - *Issues raised with participating staff*

	R	M	I	C	A	D	O	L	E
Head of Mathematics		✓						✓	✓
Member of Mathematics Dept.			✓		✓	✓		✓	✓
GNVQ staff member	✓		✓	✓	✓			✓	
Senior Management Team	✓				✓	✓	✓	✓	
Key Skills Co-ordinator	✓					✓	✓	✓	
Student studying GNVQ and GCSE Maths	✓			✓	✓	✓	✓		✓
Student studying GNVQ but not GCSE maths	✓		✓	✓	✓	✓	✓		

Key to Table 0.1

R - Role/ Background
M - Organisation of Mathematics Department
I - Involvement with other forms of Mathematics Provision
C - Contact with staff in other departments
A - Attitude to Application of Number
D - Delivery of Application of Number
O - Organisation of Application of Number
L - Links between pre/post 16 centres
E - Modular examinations

The interviews with the participants at each of the centres were designed to be semi-structured, in that schedules were developed, although these were more to focus the interview and to facilitate communication with the participant. Rather than being seen as rigid schedules which were to be followed in all cases, they were designed to form a basis for discussion which may go beyond the remit of the schedule either deeper into areas or discuss issues which the participants brought up spontaneously.

2.4 Analysis

Descriptive statistics were used to collate the results from the survey (McAlpine, 1998). Transcriptions were coded using Grounded Theory to construct a theoretical framework. Once coding was complete, the participants responses in each of the key issues (as identified by the framework) were summarised and charted so that the similarities and differences between models could be explored. During the analysis of the transcripts it became apparent that some of the themes and codes overlapped a little (McAlpine and Greatorex, 1999). This overlapping of themes may be evident in the discussion at the end of the paper.

3. Results

3.1 Sampling and Response Rate

A copy of the questionnaire was sent to all 545 centres who currently enter for GNVQs with RSA (now OCR) and taught Application of Number. A response rate of 38.3% was gained. Without knowing how centres organise their Application of Number provision, it was difficult to send the questionnaire to the most appropriate person (in the end the letters were addressed to Key Skills Co-ordinator/Head of Mathematics). The sample was broadly representative of the population of OCR GNVQ centres (McAlpine, 1998).

3.2 Survey Results

3.2.1 Association between GNVQ and GCSE Mathematics Study

In the majority of centres, at least some GNVQ candidates study GCSE Mathematics; proportionately fewer at foundation level than at intermediate or advanced level. Incorporation of AoN into GCSE Mathematics was found to be less popular as the level of GNVQ increases, probably reflecting the difference in curricular content. This trend is also apparent in centres' organisation of Application of Number (McAlpine, 1998).

There would appear to be more variation in practice as the level of GNVQ increases. This would not appear to be so strongly associated with administration (McAlpine, 1998), and perhaps reflects more the greater level of autonomy granted to students on higher level courses.

Table 0.2 - *Association between GNVQ and GCSE Mathematics study*

	foundation	intermediate	advanced
Some/all GNVQ students study GCSE Maths incorporating AoN	12 (15.0)	14 (8.2)	3 (2.1)
Some/all GNVQ students study a separate GCSE Maths course	29 (36.3)	97 (57.1)	80 (55.9)
Varies	16 (20.0)	38 (22.4)	39 (27.3)
No GNVQ students study GCSE Mathematics	22 (27.5)	18 (10.6)	16 (11.2)
Don't know/Missing	29	18	24
Total	108	185	164

Further details about the staffing and organisation of Application of Number can be found in Appendix 2.

3.3 Description of Models

The following table (3.3) summarises the characteristics of each of the models that we used to classify the centres. It should be noted that in category 2, there is variation in the way that AoN is organised, sometimes between the levels, sometimes between the subjects. This variation was also noted by Wolf (1997), so while it may be argued that these centres were merely mixing models within one institution, it did seem worthy of further investigation.

Table 0.3: *Summary of Key Identifiers and Characterisation of each of the Models*

Model	**Teachers**	**Organisation**	**Do GNVQ students study GCSE maths?**
1	Maths staff	As a separate AoN/KS course	yes - some/all study GCSE Maths separate from AoN

2[2]	Varies	Varies	varies
3[3]	Maths staff	Within a GCSE Maths course	yes - some/all study GCSE maths which incorporates AoN
4[4]	GNVQ staff	Integrated part of a GNVQ course	yes - some/all study GCSE Maths separate from AoN
5	Maths staff	Integrated part of a GNVQ course	varies

Table 0.4: *Numbers of centres in each model by centre type*

	11-16 Schools	**11-18 Schools**	**6th Form Colleges**	**FE Colleges**	**Missing/ Other**	**Total**
Model 1	6 (37.5)	37 (32.7)	1 (9.5)	12 (27.2)	1 (12.5)	57 (28.2)
Model 2	5 (31.3)	11 (9.9)	7 (33.3)	18 (40.9)	5 (62.5)	46 (22.8)
Model 3	1 (6.3)	5 (4.5)	0 (0.0)	0 (0.0)	0 (0.0)	6 (3.0)
Model 4	2 (12.5)	24 (21.6)	9 (42.9)	5 (11.4)	2 (25.0)	42 (20.8)
Model 5	2 (12.5)	26 (23.4)	2 (9.5)	6 (13.6)	0 (0.0)	36 (17.8)
Idiosyncratic	0 (0.0)	10 (9.0)	2 (9.5)	3 (6.8)	0 (0.0)	15 (7.4)
Late Returns	2	1	2	0	2	7
Total	18	114	23	44	10	209

3.3.1 Description of centres chosen as case study centres

The following is a description of the centres used for each case study. The case studies represented their model but also had their own distinct characteristics. The names of the centres are fictitious.

Model 1

The centre chosen to represent Model 1 centres was ***Elderflower Community College***. This mixed 13 - 18 school[5] was situated in a small town near the coast of England. Supported by the LEA as a County School, it had a comprehensive admissions policy and a population of over 2,000 students. It admitted all students who wished to attend the Sixth Form, although there was some concern that the Sixth Form should be seen as a rigorous place to be.

[2] A number of these centres cited "devolved management or "staffing reasons" to explain the variation in their provision.
[3] It was notable that these centres tended to be small 11-16/18 centres with limited GNVQ provision.
[4] From their comments, many of these centres implied that they would be hostile to the integration of AoN and GCSE maths as they are serving quite different purposes.
[5] as indicated on the returned survey, although official data from the DfEE states that it takes students from 11 - 18.

Model 2
The model chosen to represent Model 5 centres was ***Willow College***. This large Further Education college (approx. 16,500 students - 1,500 f/t; 15, 000 p/t) was situated on the outskirts of a market town in the centre of a predominantly rural area, from which it drew the majority of its students.

Model 3
The centre chosen to represent Model 3 centres was ***Acorn School.*** Like Elderflower Community College this was also a mixed, comprehensive, LEA maintained school, which took students from 11-18. Situated on the outskirts of a medium sized town which was close to a number of large cities, it primarily served the local community although some pupils came from further afield. The population was approximately 1,500.

Model 4
This model was represented by ***Hawthorn College***, a small mixed comprehensive sixth form college with strong ties to a local FE college, but was perceived by local 11-16 schools as "their" sixth form. The college was situated in what had been a northern industrial town, near other similar towns and a large industrial city.

Model 5
The centre which was chosen as a case study for model 5 was ***Sycamore College***. It was a Further Education college with three campuses, all situated in an inner city area in a large city in the Midlands. Until recently the college had been subsided by the LEA but this was changing due to the new arrangements for FE funding. The achievement of young people in the area at GCSE mathematics was quite low and this was reflected in the number of GCSE retakes. The FE college was a mixed, post-16 institution, with 3,000 full time and 16,000 part time students.

3.4 Results of the Qualitative Analysis

Key to codes for Staff and Students

MM - member of Mathematics dept
HM - Head of Mathematics
SMT - Senior Management Team member
KS - Key Skills Co-ordinator
GNVQ - GNVQ teacher[6]
GNVQ+GCSE - student of both[7]
GNVQ-GCSE - student of GNVQ only

3.4.1 Elderflower Community College

Elderflower Community College had settled on its structure after a great deal of trial and error - there was a feeling that they had still not settled on an appropriate method of delivery, but the structure was getting better incrementally through each incarnation. As described elsewhere, they extracted the AoN out of the GNVQ area of study, and taught it separately using specialist Mathematics teachers. They had previously experimented with delivering AoN through GCSE and although the staff obviously worked together well as a team, the structure of AoN was clearly a contentious issue, it would seem that the extraction structure was more a compromise than a deliberate strategy. The **HM** was clearly very keen on linking GCSE Mathematics and AoN:

> *yes we tried to link it with GCSE, I think that it is a good idea...I think everybody else thinks its a total disaster - they stopped me doing it*

MM was more pragmatic *...the trial [of linking GCSE and AoN] didn't work - so we moved on.* She felt that AoN needed to be delivered in a vocational context, which could not be done through GCSE, but could be when the AoN was extracted. This desire to link the numerically and the vocational context was a strong theme in **KS's** interview he felt that AoN had to be seen as distinct from "maths", and was

[6] Note that in Hawthorn College two GNVQ teachers were interviewed - these are referred to as GNVQ1 and GNVQ2 respectively.
[7] Note that in Elderflower Community College two students who were studying both GNVQ and GCSE Maths were interviewed - these are referred to as GNVQ+GCSE1 and GNVQ+GCSE2 respectively.

thus not keen on the linking of GCSE and AoN. He also felt that the importance of AoN might grow in students' minds if people other than Mathematics teachers were stressing its importance, however conceded that it *fitted happily into a maths department...* and that where *...you do have a model extracting the Key Skills then there's a lot to be said for mathematicians [teaching it].*

GNVQ felt that he was trying to integrate it into the vocational areas, although he acknowledged that the support of the numeracy staff (as he termed them) was essential, and that it should be a team effort to integrate the work being done in AoN with the work done in the vocational area. There was some resistance however from Senior Management to integrating the AoN with the vocational areas. **SMT** felt that standards were not maintained in such a set up - this had been tried in some courses before, but she felt that the tutors had been accepting inadequate evidence as proof of the attainment of an AoN competence, whether this was through a lack of interest in what may have been seen as a peripheral issue, or an inadequate grasp of the standard was not clear. She also felt that it should be Mathematics specialists who were delivering AoN.

The students seemed quite favourably disposed to this structure - **GNVQ**-**GCSE** felt that the Mathematics teachers were more able to respond to the needs of the students because of their more full understanding, going more deeply when required and also simplifying it when the students were having difficulty, and seemed keen that it should be separate - at least partially from the GNVQ. **GNVQ+GCSE** echoed **GNVQ-GCSE**'s sentiments, and was very keen that there was a *proper maths teacher* who *knew what they are talking about*.

Although the rhetoric of the staff involved in the delivery of AoN at Elderflower College seemed on the surface very similar - underneath, there seemed to be rather different opinions on how it should be delivered. **KS** was strongly in favour of contextual delivery - he felt that numeracy should be less "taught" than "pointed out", raising the numerical awareness of students; although he noted, as did **GNVQ**, that with the current specifications there were certain areas of the curriculum which could not be "naturally" fitted in to the subject area and in such cases there was no option but to teach these skills separately.

There was an element of frustration apparent when he mentioned that there was an unclear national lead on whether or not Key Skills should be integrated within the GNVQ areas of study, and noted that when it had been decided to extract the AoN, it was probably best to have Mathematics teachers teaching it, as other colleagues could often be intimidated by the idea of teaching numerical concept, even when it was well within their capabilities. Nonetheless, he did feel that it was advantageous to keep the teaching of numeracy separate from the Mathematics department - not only did this encourage more contextualisation, but also he felt that it was effective in reinforcing to students the importance of numeracy if non-Mathematics specialists were involved in its delivery.

Although **HM** shared much of the language of **KS** - that of pointing out opportunities to students and encouraging them to be more self aware and evaluative; he appeared to want a more full role for Mathematics staff in encouraging them to do this. **HM** felt that this could only be done by extracting the Mathematics out of the vocational area and pointing out to students where Mathematics could be of assistance - while it was embedded in the vocational areas he felt that students were unaware of its presence, and were missing the opportunities to practise their numeracy - in order for them to obtain the full benefit of the course, these must be pointed out explicitly.

Two members of staff (**GNVQ** and **HM**) noted that they had found problems in judging the appropriate level to pitch work and were using GCSE as a guide to the demand, although **HM** noted that recently he had started looking at AoN more in a "fitness for purpose" light.

MM felt that a major advantage of the delivery of AoN as opposed to GCSE Mathematics was the non-threatening method of delivery. She expressed a concern to provide a supportive atmosphere as she felt that many students were scared of this area, and also of being "put on the spot" and felt that the smaller classes in AoN conveyed advantage for those lacking confidence.

3.4.2 Willow College

The model 2 centre - Willow College, had responded originally that the delivery of AoN across the college varied - sometimes it was taught by Mathematics specialists, sometimes by vocational tutors, sometimes within the vocational context, without it. **KS** challenged this, however - arguing that AoN was

always integrated into the teaching of the vocational area. She had a great many links with external bodies and with other centres, in a leadership and consultative capacity and felt that the college was in the forefront of Key Skills development - she put this down to:

> *...the structure that I developed and obviously brought other people into that - whereas we initially support, we don't go in and deliver and assess the Key Skills within the vocational areas, the system that I've adopted here is to support the vocational staff in terms of resources, staff development etc., and taken that support to the department...we have a Key Skills workshop here, but its not used as much as the Key Skills workshops in other colleges, because the time is given to the departments to support and underpin the Key Skills - that's the system for the majority of programmes*

When asked why she had chosen to structure the delivery of AoN this way, she responded *...because that's the way that you're supposed to do it.* This philosophy was shared by the other members of staff around the centre, from **SMT** down, although the Mathematics staff spoke of the support that they gave to students as well as to staff, and where the lines of support and delivery were becoming blurred. There was also a feeling from **MM** that the structure was, at least in part, led by financial concerns. All staff members felt that this integrated system was a good thing, although for practical reasons did not always work out.

GNVQ+GCSE1, who had been taught AoN by his GNVQ tutor in specially demarcated lessons was less keen. He felt that this structure led to AoN being sidelined - the tutors didn't really want to spend time teaching it and he also felt that he was being somewhat short-changed. He suggested that the GNVQ teacher taught AoN because:

> *It was...because they, um probably couldn't spare maths teachers and it was probably, um convenient for them*

He felt that the delivery would be improved if the tutors had a better understanding of Mathematics and if it had been taught *as more of a GCSE sort of maths...sort of standard.* **GNVQ+GCSE2** felt that AoN had been taught as *a very integral part of...the course.* He was more positive about the arrangement - he liked being taught the Mathematics as an integrated part of the GNVQ, and preferred being taught with his GNVQ group - although he did suggest that the delivery could be improved by the introduction of Mathematics tutors to support the weaker students (amongst which he included himself).

There was desire for AoN to be delivered by the vocational tutors within the vocational areas, and the support provided for this was considerable. There was a feeling that Key Skills had to be wrapped up in the vocational areas to "sell" them to students. **SMT** reckoned that they were *difficult and unpalatable*, while **KS** was *concerned that they would lose their thrust,...if they are not marketed and sold as a package.* Relevance was an important issue which ran throughout the philosophy of the centre, particularly from **KS**:

> *[Separate Key Skills will be seen by students] as an attack on them - they'll just walk...its not the point of what Key Skills were introduced for in the first place. Key Skills were meant to be for life, they were meant to be developmental and have vocational relevance. I'm not sure that I can see the relevance of them so much if they're not linked to the job or training for the job*

HM was in favour of integral delivery for rather more pragmatic reasons, he felt that separate AoN delivery was impractical given the staffing limitations on the department, although the students were less in favour. **GNVQ+GCSE1** felt that although the teachers had tried to make the tasks relevant to the work, some of them ended up rather contrived - *awkward and quite silly.* This links to Boaler's (1993) findings that sometimes the context of mathematics problems is not realistic enough to make mathematics meaningful. This also links with Nunes et al. (1993) who have argued that mathematics teaching should use realistic problems to be more effective. **GNVQ+GCSE1** felt that the delivery of the AoN had been hurried and that the tutors were not really interested in it. He wanted the AoN to be more like GCSE and felt that employers did not really value it - all that they looked for was a GCSE Mathematics, in particular he wanted the delivery to be given to setted groups so that the work could be paced more appropriately. **GNVQ+GCSE2** did like the delivery that had been given by his GNVQ teacher and felt that the AoN and the GNVQ course had supported one another although he did share **GNVQ+GCSE1**'s perception that there had been irrelevant parts and that he was sometimes left alone to struggle and wished for specialist Mathematics support. **GNVQ+GCSE1** also suggested that certain things were taught and "ticked off". He also thought that revision later on would have been useful, but areas of AoN were often not re-visited.

MM seemed to be the least favourably dispose to this manner of delivery - he felt that the standards attained by students delivered by the vocational tutors were less than that obtained by them in specialised classes:

> *...because of the staffing constraints and budget constraints, and it seems to be working in this college is that the people that are teaching the students also deliver the Number - if we try and withdraw the students and send them to a separate centre we get a lot of rejection, a lot of poor comments; actually the students do very well doing it but there is a lot of poor comments on our questionnaires to the students, their perceptions are that they aren't doing it very well, they don't like it, but their actual achievements are better*

This observation would seem to support the beliefs of **KS** and **SMT** that separate delivery of Key Skills is not well regarded by students.

3.4.3 Acorn School

Acorn School had suggested on the questionnaire that AoN was taught entirely within GCSE Mathematics, however it quickly became apparent that they actually taught the AoN as a separate course, more akin to Model 1 than to Model 3. In general the staff and students felt quite content with the model that they had adopted. They had previously tried delivering it entirely within the vocational area, but **KS** suggested that this had not really addressed the AoN competencies and students had been claiming AoN competencies for rather trivial pieces of work. Rather than having a planned strategy to fulfil the AoN requirement, students tried to match work that they had done to the competencies at the end of the course.

One issue which was raised by some of the staff was the problem of paperwork; the administration of Key Skills in the centre was rather complicated with setted groups for each of the Key Skills. This led to a great deal of paperwork as students were recording their achievements themselves and had primary responsibility for their own record keeping. There was a feeling that this was perhaps a little too complicated for the students to manage, although there were proposals in the pipeline to streamline this administration.

Although the centre was very unified in supporting the current structure, there were obviously differences of opinion in which direction Key Skills was to go in next. **GNVQ** was keen on the idea of separate Key Skills, and was supportive of the proposal to have a separate Key Skills qualification, which she felt would add kudos to the course. **MM** commented on the similarity between GCSE Mathematics and AoN, however noting that it was important for the person delivering the AoN to have some familiarity with the GNVQ areas of study so that they could put it into an appropriate context. **HM**, although he explained at the start of the interview that he had had little dealings with AoN, during the interview noted that it might work well if it were paired with GCSE resit provision. **SMT** however, was of the opposite opinion, that Key Skills should ideally be integrated into the area of study wherever possible, however felt that the structure that they had at the moment was the most appropriate one to their stage of development - eventually **SMT** wanted the Key Skills provision pushed back into the departments:

> ***SMT*** *...I do think that the route that we have gone down is not the correct route at the moment, but I wanted to get Key Skills piloted, I wanted it off the ground. I wanted it to become an issue for our Sixth Form students that skills are important and that it is not just the content of the subject that you're studying which gets you the top grade, whether it be GNVQ or A Level. I shall be much happier when Key Skills can be taught through History, through Maths, through Geography to whatever and that we can push it back into the subject areas and the tracking is also done through the subject areas rather than through the discreet lesson.*
>
> ***Interviewer*** *But you think that the structure that you've got now...brings it to the fore and promotes it so that once it does go back into the subject departments they can't ignore it*
>
> ***SMT*** *Absolutely, absolutely...*

There was a strong link in the minds of the students attending Acorn School between the delivery of AoN and the delivery of Mathematics. **GNVQ+GCSE** reckoned that AoN was simply GCSE work

repackaged, albeit less interesting and unchallenging. **GNVQ-GCSE**'s comment, although more positive, suggesting that she viewed AoN as a useful refresher course on GCSE mathematics, echoed this.

The staff who had contact with the Mathematics department, also viewed AoN in relation to GCSE Mathematics. Through the course of the interview, **HM** expressed interest in linking re-sit GCSE Mathematics with AoN, although it seemed that this had not really occurred to him previously; while **MM**, although expressing strong caveats that AoN must be seen as distinct from GCSE, mentioned the joint resources that had been produced and the advantages of dual provision. She mentioned that in her (separate) GCSE class she had tried to build in links to support aspects of AoN so that the students could take advantage of additional support. She also mentioned that delivery was entirely left to the AoN teachers, and that GNVQ subject area teachers played no part in its provision.

Those teachers who were slightly more removed from the Mathematics Department tended to take a more integrated attitude towards AoN, and problems were noted with the current form of delivery. **KS** noted that clear delivery of the objectives has been ensured by the structure that they have adopted. He mentioned that he felt that the students were being rather *force-fed* AoN but that they have tried other methods of delivery which have not worked and settled on this as a practical solution. **SMT** was also concerned at the manner of delivery adopted at the current time, although he agreed with **KS** that this had been settled on as a practical rather than a desirable solution. He suggested that at the moment the delivery was rather prescribed. In future he hoped that the AoN would be delivered through the subject areas, so that it could be delivered in a manner that allowed students to see that these are transferable skills.

The concept of "selling" AoN to students was also mentioned. Both **KS** and **GNVQ** noted that this form of delivery caused problems in the motivation of students. **GNVQ** noted that students resented its provision, seeing it as an unnecessary extra and felt that this would not be so much of an issue were it more integrated into the major subject of study.

3.4.4 Sycamore College

Sycamore College provided AoN by using Mathematics teachers to deliver it, while the course tutors focused on the vocational aspects of the course. Ideally a partnership arrangement was in place although in practise, as noted by **GNVQ**, this was not always implemented. **HM** explained that originally Key Skills had been part of the vocational staff's remit, but this had led to it being marginalised. A plan to centralise the Key Skills provision was developed, but the logistics of this proved highly impractical. The centre had thus moved to a partnership model, whereby the specialists would undertake the delivery of AoN with the assistance of the vocational staff, with a view to eventually handing the responsibility back to them.

Unfortunately the vocational staff seemed rather unwilling to embrace it. **KS** noted that the lack of staff time and commitment to AoN together with low student motivation had led to a rather "bolt-on" approach, which had not been the original intention.

SMT noted that the centre was trying to combine AoN classes, workshops and "study link drop in sessions" in order to provide appropriate support for all of their GNVQ students. She noted that the ideal was to have students who were committed to improving their own Key Skills, and that this could only happen if the teaching was integral to the vocational areas, but staff resistance to this had limited its application. She went on to comment that the integration of Key Skills into the vocational areas that they had achieved, although not complete, had been a struggle.

This resistance to integration on the part of the GNVQ staff was evident in the interview with **GNVQ** who was keen to delegate AoN to specialist staff:

> *...in an ideal world, what would happen is that I would be delivering my bit vocationally, [and] the maths person would be delivering the number that they needed at the time*

She noted that there was a high level of liaison between the Mathematics staff and the GNVQ staff, but that the GNVQ staff tended to feel rather out of their depth, especially at advanced level. She felt that GNVQ staff could make a more effective contribution by liaising fully with the specialist staff, and ensuring adequate coverage of the curriculum rather than becoming involved in the AoN delivery.

There was some concern at Sycamore College that the Application of Number aspect of the course was too "bolt-on", and did not really lead to an ideal level of integration of the number within the vocational areas. **SMT** suggested that this could in part be responsible for the lack of motivation that student showed for AoN.

There was much talk of liaison between the GNVQ staff and the specialist staff who were delivering AoN, and this was clearly an aim of the model that they were adopting, however for a number of reasons: lack of time; lack of enthusiasm; lack of confidence and a gulf between the understandings of the specialists and the GNVQ staff, this did not appear to be happening as much as might be desirable.

The concept of "selling" courses to students was also evident - the AoN provision was comprised of a number of parts, some compulsory and some voluntary. There were concerns raised by a number of staff that the AoN was not really fulfilling its brief of producing students who were able to use number confidently in the vocational settings. SMT suggested that more compulsion for numerically weaker students may help them achieve this, however this was resisted by the vocational staff who felt that students may drop out of courses, or not enrol if they felt that AoN was to be a major commitment.

3.4.5 Hawthorn College

Hawthorn College suggested on the questionnaire that it delivered its provision of AoN entirely within the vocational area and although it was noted by a number of teachers that occasionally something would not fit in very well and would have to be taught separately; there seemed to be a feeling that this was a weakness in the AoN specifications, rather than a weakness in the method adopted by the centre. This feeling was perhaps expressed most strongly by **GNVQ**, who thought the AoN specifications superfluous as numeracy was such an integral part of the course that to do the assignments for the subject area, they must have shown well developed numerical skills.

The model seemed to be well regarded, **GNVQ2** expressed a preference for that method of organisation because it *made it natural.* The assessment opportunities were allowed to flow from the work that the students were doing and there was a reinforcement of work that had been done earlier and made the students realise how integral a part numeracy was to Business Studies. **GNVQT** felt that the students found this structure the easiest - that although they could not do something at GCSE, they were more able to use the technique as a tool to find something out as they found it easier.

Some reservations with this approach were none the less found in the Mathematics department. **HT** acknowledged that numeracy was much more acceptable to students when *disguised* as Business Studies, none the less had doubts about:

> *whether the way [that it is] deliver[ed] does maximise student potential in number*

and suggested that formal lessons or workshops might improve students' achievements. She suggested that AoN in its current form (as delivered by the college) might be good for those who have already passed GCSE, but those who are not confident or are afraid of Mathematics get little out of it. This feeling was echoed in a comment made by **GNVQ**:

> *I suppose the only thing is occasionally you get a student who might be left behind because they haven't got the basic skills and its obviously difficult then, for me as a finance teacher to sort of bring them up to scratch*

The reactions of the two students to the structure also seemed to back up **HT**'s hypothesis. **GNVQ-GCSE**, suggested that she understands the Mathematics better this way - *you're doing it and its going to be something that you're going to have to do one day when you are working,* she went on to suggest that this embedded structure made it interesting because it was work based and easy to relate to and gave her a different "slant" on GCSE Mathematics. **GNVQ+GCSE** on the other hand, who was resitting GCSE Mathematics, seemed to be struggling - she found the content harder than the GCSE, although she felt that tying AoN together with the GNVQ area of study was the best way to organise it, none the less she felt that an additional lesson devoted to Application of Number would give valuable support.

The delivery of AoN in Hawthorn College seemed to be characterised more by its lack, than by any of its attributes. Although the structure suggested that the AoN were delivered in an embedded fashion, it would seem that this was how they were assessed, but there was little actual delivery. Several teachers mentioned that students needed to come to the GNVQ course already equipped with the numerical skills that they would need. **HT** suggested that:

students who are doing GNVQ courses need a really big standard of numerical ability… quite a number of them are not numerate when they start the course and never really become it

and thought that AoN was about:

putting the maths that they have already learnt into the GNVQ context. (authors' emphasis).

While **KS** suggested that:

… it is very false if what you do is you're teaching marketing or any subject and then all of a sudden you've got to stop to teach a tool that they ought to come to the lesson with

There was support available, for students who were having difficulty, however there was a feeling that the students should already come to the lessons with skills that they needed to do the course. This appeared to be causing problems for the students. While the student who had already achieved her GCSE was coping well with the AoN, she thought that students who had not already achieved GCSE would find it difficult, although she felt that this method of delivery ensured that no-one was left behind. **GNVQ+GCSE**, who was resitting her GCSE for the second time seemed rather disheartened by the AoN aspect and felt rather out on a limb:

with [GCSE] maths its there - we've got to do what it says, just questions, questions, questions, in maths its not about going out to the library and looking for different things, we've got what we need in the book and that's all we need for the lessons but with Application of Number, its going out and finding the work, sitting down and writing it all out and getting it back if you've done it wrong and going out again and doing it all out again

Supporting the suggestion of **GNVQ-GCSE** that students who had not already achieved GCSE would find it difficult, she did however feel rather left behind by the rest of the class and preferred the more collective approach in her GCSE Mathematics class to the individualised learning in the AoN.

4. Discussion

4.1 Organisational Structures in use

Despite the early identification of five models from the questionnaire responses, it is apparent that the organisational structures which are in use are really variations on two themes - AoN delivery by the Mathematics staff as a distinct entity; used in Elderflower Community College, Sycamore College and Acorn School, and delivery by the GNVQ staff as an integral part of the GNVQ, used in Willow College and Hawthorn College. Nonetheless, each centre had its own distinct "flavour" of GNVQ delivery. In Willow College, Mathematics staff were requested to provide support for the vocational staff, while in Hawthorn College, the Mathematics department had little involvement. It is notable that both the 11-16/18 centres - which did not have such a strong tradition of vocational education, AoN was delivered by Mathematics staff.

4.2 Development of organisational structure

The three centres which had settled on a separate AoN delivery by Mathematics specialists, had all settled on that structure following a period of experimentation, while the other two centres had adopted their method of delivery at the start, and had deviated little from their original method of organisation. The integrated style of delivery was certainly the model which was most heavily emphasised in the original Key Skills materials, although recently the choice of approach would appear to be more relaxed (Elliot and McAlpine, 1998). In Willow College there was an element of dogmatism in the Key Skills Co-ordinators response when asked why they chose to organise their delivery in this manner, while at Hawthorn College there were a number of hints that AoN was being "under-delivered".

A number of theorists have suggested that integration of mathematics is the most effective manner of learning. Lave (1988) has noted that knowledge is culturally and socially situated and as such, situating

mathematics in context leads to more effective learning. Hutton (1997) looking at the role of mathematics in the education of nurses, has suggested that the techniques of mathematics need to be learnt, or discovered, through problem solving before they can be applied to further problem solving. This would suggest that the integrated approach would be more effective, however the centres which developed their delivery strategy more organically had opted for distinct delivery. There are definite issues around the numerical abilities and confidence of vocational staff, and the practical problems involved in an integrated approach, however the discrepancy between research findings and the findings of those at the chalk-face merit comment.

4.3 Staff Reactions

4.3.1 Heads of Mathematics

The Heads of the Mathematics department were most keen on the combining of AoN provision with that of GCSE Mathematics, although their enthusiasm was generally limited to GCSE resit students, although the practical constraints of staffing were noted. It was also felt that this would not be popular with other members of staff and indeed in the centre where this mode of delivery had been experimented with (Elderflower Community College) it had not been popular.

4.3.2 Members of Mathematics department

The members of the Mathematics department who were interviewed were ambivalent about the best method of delivering AoN. There was an agreement that the vocational context was important, although there were concerns both that it must be seen as distinct both from GCSE Mathematics and from GNVQ. It was felt that when it was delivered entirely within GNVQ, the number element tended to "get lost" within the context, however when it was delivered as a part of Mathematics provision students were "turned off". There was a feeling that separate delivery of AoN conveyed particular advantages for students who were weak at numeracy, allowing them to identify and name their weakness (rather than it getting lost within the GNVQ area of study) and helping them to achieve in a non-threatening environment (which they felt Mathematics classes were for many weak students).

4.3.3 Key Skills Co-ordinators

The Key Skills Co-ordinators were more varied in their views. There was a feeling that the philosophy of GNVQ and of AoN led to an integrated delivery method, and that an imposed separation of AoN was false, however they noted the difficulty of achieving adequate delivery when it was entirely integrated. There was some concern that AoN may be rejected by students if it was seen as a part of Mathematics, although it was noted that it did fit happily within the context of a Mathematics department this was seen as a "lazy" solution in some centres. Key Skills Co-ordinators were very much a pivotal point in all of schools - reflecting and compromising the views of the other staff members. They were obviously highly active agents in developing the schools' models of delivery regardless of how much responsibility had been formally delegated to them.

4.3.4 Senior Management Team Members

One of the most common concerns voiced by the SMT members interviewed was that of standards. It was felt that an integrated approach did not push AoN as much as was necessary for the students to fully achieve. Most SMT members were committed to integrated delivery as an ideal, but felt that some measure of separation was desirable for practical reasons. There was also some concern about students perceptions when AoN was separated out as a distinct area of study - they felt that this may cause students to be less enthusiastic about their studies when AoN was heavily pushed. This tension between standards and popularity came through strongly.

4.3.5 GNVQ Teachers

There was some resistance on the part of GNVQ teachers to delivering AoN. There was understated enthusiasm for an integrated approach - a feeling that this made AoN more palatable, however there was also a feeling that they were straying into an area which was not really their responsibility, and a

vague feeling of being out of their depth. Several supported the idea of a separate Key Skills qualification and acknowledged the support of the Mathematics department in assisting them to deliver the material.

4.4 Student Reactions

4.4.1 Students studying GNVQ but not GCSE Mathematics

There was some feeling among the GNVQ students who were not studying GCSE Mathematics, that they would like additional support with their AoN studies. This feeling was strongest in the centres were AoN was taught in an integrated fashion. There was a perception on the part of staff (noted above) that students were not really motivated to study AoN. This would appear to be the case, the students who were not studying GCSE Mathematics tended to regard AoN either as a useful, but rather unnecessary refresher of GCSE or as an irrelevance. There was a feeling that AoN was not "worth" terribly much - and that it was not valued "in the real world" in the same way as GCSE Mathematics was.

4.4.2 Students studying both GNVQ and GCSE Mathematics

The students who were studying both GCSE Mathematics and GNVQ were generally resitting GCSE following a previous failure, and this undercurrent of failure in this area was evident through their interviews. These students tended to feel somewhat adrift in their AoN studies. This feeling was strongest in those centres where GCSE was taught in an integrated fashion. There was a feeling that GCSE had clearer objectives than AoN. These students also felt that AoN was not valued as much as GCSE and the priority was to achieve GCSE Mathematics rather than to achieve in AoN, which they were motivated to achieve only through the assessment requirements of the GNVQ rather than intrinsic motivation in the subject.

5. Conclusions

The experience of the first few years of Application of Number has been a trying time in many centres. This is a new area for many centres and many have fallen back on the old certainties of GCSE Mathematics, and Numeracy to help them through. Centres appear to have started at two broad positions - complete integration or complete separation with the vocational area of study - through negotiation and compromise the majority of the centres that we looked at have arrived at a position of semi-integration: AoN delivered by Mathematics specialists, separate but heavily linked to the vocational context. The other two centres have continued with their initial policy of complete integration. In one of the centres the inadequacies of this provision were mentioned several times, in the other there were hints that the Mathematics department may be providing more support to staff and students than was officially acknowledged.

There were clearly a number of different issues being debated in the centres that we looked at, informing the development of this area and drawing the boundary lines for the experiences that the staff and students had, however there was also a number of issues which permeated beyond Application of Number and existed in a dynamic of national and local policy. In these debates which were raised across a number of different schools it becomes apparent how government initiatives are interacting; sometimes in symbiotic harmony, sometimes in tension.

The issue of standards was high on the agenda of the majority of the Senior Management Team members. There was a feeling that AoN was a very positive development and could contribute generally to raised standards, however they were concerned that their delivery methods ensured the highest possible quality of AoN provision. This concern for standards resonated through the other staff interviews, again the majority of them believing that AoN (and key skills in general) could contribute to increasing the competence of students leaving education.

All in all the experiences of the staff and students participating in these early days of Application of Number appears to be one of trial and error, sifting through strategies, determining priorities and outcomes until the most palatable solution arises. In some cases, the solution is decided on first and

then appropriate methods of implementation are developed, in others methods of implementation give rise to solutions.

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Appendix 1: Questionnaire sent to Centres

Links between GNVQ Application of Number and GCSE Maths

School/College: _____

Contact Name: _____

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1. How would you describe your centre

11 - 16 school	☐
11 - 18 school	☐
Sixth Form College	☐
Further Education College/Tertiary College	☐
Linked school and college provision	☐

2. Which GNVQ(s) do you offer in your centre? *(tick all which apply)*

	foundation	*intermediate*	*advanced*
Art and Design	☐	☐	☐
Business	☐	☐	☐
Construction and the Built Environment	☐	☐	☐
Engineering	☐	☐	☐
Health and Social Care	☐	☐	☐
Hospitality and Catering	☐	☐	☐
Information Technology	☐	☐	☐
Land and Environment	☐	☐	☐
Leisure and Tourism	☐	☐	☐
Manufacturing	☐	☐	☐
Media: Communication and Production	x	☐	☐
Performing Arts and Entertainment Industries	☐	☐	☐
Retail and Distributive Services	x	☐	☐
Science	☐	☐	☐

The following questions provide the opportunity to reply separately with regard to different GNVQ levels. Please complete those which are relevant to your institution, ticking only one box for each level unless otherwise instructed.

3. Who teaches the Application of Number (AoN) aspect of GNVQ?

	foundation	*intermediate*	*advanced*
GNVQ staff	☐	☐	☐
maths specialists	☐	☐	☐
basic skills teachers	☐	☐	☐
varies depending on GNVQ	☐	☐	☐

if your strategy varies, please explain why

_____

_____

4. Have you made any training in teaching AoN available to your staff?

	foundation	*intermediate*	*advanced*
yes - provided by awarding body	☐	☐	☐
yes - provided by commercial provider	☐	☐	☐
yes - provided by another member of staff	☐	☐	☐
no - already trained to teach maths at this level	☐	☐	☐
no	☐	☐	☐

5. Is AoN organised

	foundation	*intermediate*	*advanced*
as an integrated part of a GNVQ course	☐	☐	☐
by self-study within a GNVQ course	☐	☐	☐
as separate teaching units within a GNVQ course	☐	☐	☐
within a Key Skills course	☐	☐	☐
as a separate Application of Number course	☐	☐	☐
within a GCSE maths course	☐	☐	☐
varies according to GNVQ area of study	☐	☐	☐

6. Why did you decide on this strategy for teaching Application of Number?

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

7. How do GNVQ portfolios incorporate AoN proof of competencies?

	foundation	*intermediate*	*advanced*
separate assessments showing AoN competencies	☐	☐	☐
competencies shown within mainstream assignments	☐	☐	☐
mixture	☐	☐	☐
varies depending on GNVQ area of study	☐	☐	☐

*If Application of Number is **always** taught by maths specialists, please go to question 9.*

8. When Application of Number is not taught by maths specialists, does the maths department have any input? *(tick all which apply)*

	foundation	*intermediate*	*advanced*
no	☐	☐	☐
yes - advise on planning/activities	☐	☐	☐
yes - sharing resources	☐	☐	☐
yes - consultancy	☐	☐	☐
yes - other, please specify	☐	☐	☐

_____

_____

*If Application of Number is **never** taught by maths specialists, please go to question 11.*

9. When Application of Number is taught by maths specialists, is teaching and learning

	foundation	*intermediate*	*advanced*
often directly integrated with current GNVQ activities	☐	☐	☐
often set in the context of the GNVQ area of study	☐	☐	☐
sometimes set in the context of the GNVQ area of study	☐	☐	☐
usually without reference to the GNVQ area of study	☐	☐	☐

10. Where Application of Number is taught by Maths specialists, would you like to increase the level of integration with the GNVQ courses?

	foundation	*intermediate*	*advanced*
yes	☐	☐	☐
no	☐	☐	☐
no strong view	☐	☐	☐

11. Do your GNVQ students also study GCSE mathematics?

	foundation	*intermediate*	*advanced*
yes - some/all study a GCSE mathematics course which incorporates AoN teaching	☐	☐	☐
yes - some/all study a separate GCSE mathematics course	☐	☐	☐
varies - according to GNVQ area of study or for other reasons	☐	☐	☐
don't know	☐	☐	☐
no	☐	☐	☐

If any of your students take a GCSE maths course which incorporates Application of Number teaching, please complete questions 12 - 16, otherwise please turn to question 17 on page 5

	foundation	*intermediate*	*advanced*
12. How many students take GCSE maths courses incorporating Application of Number?	_____	_____	_____

13. Does/do any of your GCSE syllabus(es) include coursework?

	foundation	*intermediate*	*advanced*
yes	☐	☐	☐
no	☐	☐	☐

14. Are your AoN competencies gained from... *(tick all which apply)*

	foundation	*intermediate*	*advanced*
...GCSE coursework?	☐	☐	☐
...linked AoN/GCSE (coursework) assignments?	☐	☐	☐
...AoN assignments/GNVQ assignments?	☐	☐	☐

15. Do you feel that work is sometimes being duplicated to produce both evidence of Application of Number competencies and GCSE Maths coursework?

	foundation	*intermediate*	*advanced*
often	☐	☐	☐
sometimes	☐	☐	☐
rarely	☐	☐	☐

16. What problems do/would you experience linking AoN coursework with GCSE Maths?

If your GNVQ students do not take a GCSE maths course, please turn to question 19 on the following page.

17. Which GCSE Maths Syllabuses do you currently use?

	foundation	*intermediate*	*advanced*
Edexcel Maths Syllabus 1385	☐	☐	☐
Edexcel Maths Syllabus 1386	☐	☐	☐
Edexcel Maths Syllabus 1751	☐	☐	☐
Edexcel Maths Syllabus 1786	☐	☐	☐
NEAB Maths Syllabus A	☐	☐	☐
NEAB Maths Syllabus B	☐	☐	☐
NEAB/WJEC Statistics Syllabus 1137	☐	☐	☐
OCR Maths Syllabus A	☐	☐	☐
OCR Maths Syllabus B SMP (11-16)	☐	☐	☐
OCR Maths Syllabus C SMP Graduated Assessment	☐	☐	☐
OCR Maths Syllabus D/E (MEI)	☐	☐	☐
SEG Maths Syllabus 2500	☐	☐	☐
SEG Maths Syllabus 2510	☐	☐	☐
SEG Statistics Syllabus 2580	☐	☐	☐
WJEC Maths Syllabus A	☐	☐	☐
WJEC Maths Syllabus B	☐	☐	☐
other	☐	☐	☐

If any of the syllabuses that you currently use are modular, please complete question 18, otherwise go straight to question 19 on the following page.

18a. Do the majority of your GNVQ candidates complete their GCSE maths course in...

	foundation	*intermediate*	*advanced*
...one year?	☐	☐	☐
...two years?	☐	☐	☐

18b. When do you enter GNVQ candidates for their first GCSE maths module?

Spring/Summer of first year of course (for two year courses)	☐	☐	☐
Autumn/Winter of final year of course (for one and two year courses)	☐	☐	☐
Spring/Summer of final year of course (both one and two year courses)	☐	☐	☐
varies dependent on candidates' abilities/preferences	☐	☐	☐
still experimenting with different entry patterns	☐	☐	☐

19. Please indicate your opinion on the following statements by circling 1-5

Modular examinations...

...motivate candidates more than linear examinations

strongly disagree 1 2 3 4 5 *strongly agree*

...lower standards

strongly disagree 1 2 3 4 5 *strongly agree*

...are easier than linear examinations

strongly disagree 1 2 3 4 5 *strongly agree*

...suit some candidates but not others

strongly disagree 1 2 3 4 5 *strongly agree*

...grade for grade, produce more competent students than linear examinations

strongly disagree 1 2 3 4 5 *strongly agree*

...support better forms of teaching than linear examinations

strongly disagree 1 2 3 4 5 *strongly agree*

Re-sitting a module...

...is a form of cheating

strongly disagree 1 2 3 4 5 *strongly agree*

...encourages students to become independent learners

strongly disagree 1 2 3 4 5 *strongly agree*

...encourages students to be lazy

strongly disagree 1 2 3 4 5 *strongly agree*

...encourages perseverance

strongly disagree 1 2 3 4 5 *strongly agree*

...ensures candidates get the best grade that they are capable of

strongly disagree 1 2 3 4 5 *strongly agree*

...can overload candidates

strongly disagree 1 2 3 4 5 *strongly agree*

Early entry of module components...

...disadvantages candidates, as they have not had the benefit of the whole course

strongly disagree 1 2 3 4 5 *strongly agree*

...gives candidates a sense of achievement

strongly disagree 1 2 3 4 5 *strongly agree*

...ensures that candidates have an even workload

strongly disagree 1 2 3 4 5 *strongly agree*

...makes the exam easier

strongly disagree	1	2	3	4	5	*strongly agree*

...gives candidates important test taking experience

strongly disagree	1	2	3	4	5	*strongly agree*

...demotivates candidates who do not do well

strongly disagree	1	2	3	4	5	*strongly agree*

20. Any further comments?

continue over page if necessary

Please return this questionnaire in the enclosed reply paid envelope.

Between September and November, we will be conducting further research on this topic. We will select a number of centres, and will interview certain key members of staff in the institution and a number of students.

These are likely to include:

- Head of Mathematics department
- Member of maths department
- Member of staff (not maths department) who delivers GNVQ
- Member of Senior Management Team
- Key Skills Co-ordinator
- Student studying GCSE mathematics
- Student studying (primarily) GNVQs, but not GCSE maths

Each of these interviews should take about 30 - 45 minutes, and would be held over the course of 2-3 days. These will be conducted at a time of the interviewee's convenience, and every effort will be made to minimise any disruption.

Would you be willing to participate in further research?

yes ☐
no ☐

Appendix 2: Further details of the survey results

Table A1 - *Staffing of AoN by level of GNVQ*

	Foundation	Intermediate	Advanced	Overall
GNVQ Staff	34 (34.7)	44 (24.9)	41 (26.3)	60
Mathematics specialists	33 (33.7)	78 (44.1)	62 (39.7)	99
Basic skills	6 (6.1)	3 (1.7)	7 (4.5)	11
Varies	25 (25.5)	52 (29.4)	46 (29.5)	61
Missing	10	8	8	6
Total	**108**	**185**	**164**	**209**

Table A2 - *Organisation of Application of Number*

	foundation	intermediate	advanced
integrated with GNVQ	36 (36.0)	62 (34.4)	58 (37.2)
self study	0 (0.0)	2 (1.1)	1 (0.6)
separate teaching units within GNVQ	18 (18.0)	29 (16.1)	29 (18.6)
separate key skills course	3 (3.0)	7 (3.9)	4 (2.6)
separate AoN course	7 (7.0)	15 (8.3)	10 (6.4)
within GCSE Mathematics course	5 (5.0)	3 (1.6)	2 (1.3)
varies	31 (31.0)	62 (34.4)	52 (33.3)
missing	8	5	8
Total	**108**	**185**	**164**