Evaluating the MEI 'Enabling Access to Further Mathematics' Project

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Abstract

Mathematics in Education and Industry (MEI), with funding from Gatsby Technical Education Projects (GTEP), ran the 'Enabling Access to Further Mathematics' project from 2000 to 2003. This pilot project was designed to provide AS- and A-level students with additional opportunities to study Further Mathematics, through the use of distance-learning materials. This was in response to the dramatic decline in the numbers of students taking Further Mathematics over the last four decades. An independent evaluation of the project was commissioned by GTEP, and this paper describes the methodology of the evaluation and its findings. In addition to highlighting the benefits of the project for students and institutions involved, the paper discusses how the project could be developed in the future, based on the issues and difficulties raised in the evaluation.

1. Background

The number of students participating in A-level Further Mathematics has declined dramatically over the last forty years. Figures from the London Mathematical Society (London Mathematical Society, 1995) showed that the number of double mathematics entries in England and Wales fell from 15,600 to 5,400 in 1994. This corresponded to an actual rise in single mathematics entries from 43,200 to 56,900. There have been some signs of improvement more recently (Heard, 1998), with double mathematics entries in A- and AS-level rising from 5400 in 1995 to 7400 in 1997 for students in England, Wales *and* Northern Ireland. However, the numbers doing Further Mathematics remain a small fraction of single mathematics entries. Reasons put forward for this decline in student numbers include (from Stripp, 2001)

- The cost of running Further Mathematics courses in schools with such small numbers taking the subject.
- A lack of suitably qualified mathematics teachers able to teach the subject.

It was felt that the problem could become worse with the introduction of Curriculum 2000, emphasising the importance of 'breadth' in post-16 education.

There have been very few comparative distance learning projects, or their evaluations, at the pre-university stage in the UK. A search through the research literature failed to find any other evaluations for distance-learning initiatives in mathematics for students in secondary schools or colleges[1]. Rather, those evaluations that were found were for courses aimed at undergraduate or postgraduate students. (Examples of some UK-based initiatives are Williams, 2002, Issroff and Eisenstadt, 1997, and Tanner and Jones, 2000.) This paper

[1] This search was done through the electronic databases of the British Education Index and ERIC, using 'evaluation' and 'mathematics' as search terms.

therefore provides a description and an evaluation of a distance education project carried out at this earlier stage of learning.

2. Structure of the 'Enabling Access to Further Mathematics' project

In response to the declining student numbers in Further Mathematics, Mathematics in Education and Industry (MEI) set up the 'Enabling Access to Further Mathematics' project. This was a three-year pilot project, designed to provide students with the opportunity of studying the subject and 'to show that it is possible to teach Further Mathematics effectively and economically by distance-learning' (Stripp, 2001). Access to learning was provided through distance-learning materials available on MEI's website. Designated lead centres provided administrative support for schools and colleges taking part in the project. Tutors from these lead centres provided learning support to students through video-conferencing, e-mail, telephone and fax contact, as well as face-to-face meeting between tutors and students.

The pilot study ran for three years (2000 to 2003), the first year involving the development of the distance-learning materials, and the project being run with lead centres and schools/colleges in 2001/02 and 2002/03. The project involved four lead centres; a FE/sixth form college, an 11-18 comprehensive school and two universities. The funding for the school and one of the universities, enabling them to take part in the project, was provided by the Gatsby Technical Education Projects (GTEP) organisation. The FE college was funded by the Learning and Skills Development Agency, and the other university funded themselves through 'widening participation' funds available to them. It was proposed that the project would become self-financing through a charge, payable to the lead centre, being made to schools/colleges to become members in the scheme. The funding to pay this charge was to be obtained by schools/colleges from Learning Skills Council funding, although additional funding could possibly be obtained from sources such as 'Excellence in Cities' or 'Gifted and Talented' funding. As well as being part of the distance-learning project, schools/colleges could alternatively ask for access to the web-based resources to use in their mathematics teaching. This involved a small fee payable directly to MEI by the schools/colleges.

3. Evaluation Methodology

This evaluation of the Further Mathematics project was commissioned by GTEP with the aim of determining what worked and what needed improving as part of the project, thereby informing the future development of this initiative. To determine the overall impact of the project and the various difficulties it entailed, data from a number of different sources was gathered together for the study:

- Interviews with the lead centre tutors in all four centres.
- Interviews with mathematics teachers from three schools taking part in the project. These were chosen through recommendations via the lead centre contacts, the interviews being restricted to three, based on the availability of the contacts for interview and time constraints on the evaluation.
- Questionnaires sent to the contacts from schools/colleges taking part in the project.

- Questionnaires sent to the contacts from schools/colleges that were not part of the project but were using the distance-learning materials to supplement their teaching of mathematics.
- Questionnaires were sent to Year 12 and 13 pupils participating in the project in 2002/03.

The interviews with tutors and teachers were carried out face-to-face with the researcher, except in the case of one lead centre where the interview with the tutor was carried out by telephone. The interviews were organised in a semi-structured manner, with pre-defined questions used to explore the following issues concerning the project:

- The aims of the project.
- The take-up of the project.
- The implementation of the project.
- The collaboration between different parties involved.
- The quality of the learning resources.
- The impact on student achievement and attitude towards mathematics.
- The wider impact of the project.
- The financing of the project.
- Lessons for future development.

All interviews were recorded and transcribed, with transcripts sent to interviewees to allow for any corrections or retractions that they may have wished to make.

The questionnaires to teachers and students looked at their perceptions towards a variety of issues, including how they viewed the distance-learning course, their views on the web-based resources, the lead centre support and the benefits and costs of the project. The students were also asked about their attitudes towards mathematics. MEI provided the names of the schools and colleges taking part in the project or using the distance-learning materials. The contacts from the institutions taking part in the project provided the names of students in Year 12 or 13 who were doing the distance-learning course in 2002/03. The numbers of questionnaires that were sent out and received back were

Table 1: Numbers of questionnaires sent out and received in the evaluation

Questionnaire to:	Number sent out	Number received	Response rate
Schools/Colleges taking part in the project	24	10	42%
Schools/Colleges just using the distance-learning materials	62	33	53%
Year 12 and 13 students	61	15	25%

Possible reasons for the low response rate for students was that they had to be contacted by e-mail in most cases, and that the addresses may not have been up-to-date. Also, most of the Year 13 students had left school or college when the questionnaire was sent out, adding to the difficulty of contacting them.

4. Findings

The findings of the various parts of the evaluation are presented below. These findings are separated into the different themes emerging from the study. Questionnaire data is used to support the statements made in the interviews, but because of the small numbers of questionnaires returned, no statistical analysis is carried out on the data. Rather, the data is presented simply as the number of responses to each question. In addition to direct quotations being used from the interviews with lead centres and schools, some open comments from the student questionnaires are presented to illustrate their views.

Accessing Further Mathematics

Perhaps the most important question that the evaluation needed to answer was whether the project increased access for students to Further Mathematics. The responses from schools suggested that this was perceived to be the case, with the additional benefit of departments being able to show that they could offer Further Mathematics.

> *"The guy who runs the 6th form school welcomes it. He sees it as a nice diversification from what we normally offer, and he also sees these gifted students coming in to us and we should be able to offer it because we're a strong department. It's just because of time, space, staffing and monetary constraints that we can't. I couldn't take four hours a week for one student. The Bursar would string me up, it just wouldn't be viable, but we can do it this way and it's a good way to do it. It's been proven that it works this way."*

In one case, being able to provide Further Mathematics gave the school the opportunity of seeing whether the course could be provided 'in-house' in the future. The questionnaire responses from schools/colleges and students certainly indicated there was an impact on the accessibility to the subject (**Table 2**).

Table 2: Questions relating to accessibility to Further Mathematics

Did your department teach Further Maths before the start of the MEI project?		
(Responses from schools/colleges)		
	No	6
	Yes	4
In the absence of the MEI course, would you have been able to study Further Mathematics?		
(Responses from students)		
	No	13
	Yes	2

Attainment and attitude towards mathematics

Another important issue for the project was its impact on student attitudes and attainment in mathematics. **Table 3** shows the available examination results for students having taken part in the project. Averaging over the results from both years, the drop in grade going from mathematics to further mathematics was 0.5 of a grade for both the AS- and A-level further mathematics grade. Although we were dealing with small numbers of

students, this seemed to be comparative to data from students not taking part in the distance-learning project[2].

Table 3: Examination results for students involved in the project

2001/02 Examination Results		2002/03 Examination Results	
Standards A-level Mathematics Grade	AS-level Further Mathematics (or full A-level if indicated) through project	Standards A-level Mathematics Grade	AS-level Further Mathematics (or full A-level if indicated) through project
A	A	A	A (full A-level)
B	A (full A-level)	B	B (full A-level)
A	A	A	B (full A-level)
A	B	A	B (full A-level)
C	E	A	A
A	A	A	A
A	A	A	A
A	B	B	B
D	E	D	A
U	U	B	C
A	A	C	D
B	A	A	B
A	B	A	B (full A-level)
C	D	A	B
B	D	A	A
B	E	A	A
A	B	B	C
A	A	B	B (full A-level)
		A	C
		A	A
		A	A
		B	D (full A-level)

Regarding the attitudes towards mathematics for those taking part in the project, **Table 4** shows that, despite the small student numbers, there seemed to be a clear indication of positive attitudes and perception of benefits from the project.

Table 4: Questions relating to student attitude towards mathematics

	Strongly Agree	Agree	Not sure	Disagree	Strongly Disagree
Studying Further Mathematics has benefited my other subjects	6	5	2	-	1
My other subjects have suffered due to the demands of Further Mathematics	-	1	5	2	6
Studying Further Mathematics has deepened my interest in Mathematics	8	4	-	2	-
The study of Further Mathematics has made me more likely to study Mathematics at university	6	4	1	1	2
Studying Further Mathematics has benefited my A level Maths studies	9	2	2	-	-

[2] 2003 data from the University of Durham's ALIS (A-level Information System) project showed that the average grade drop for students taking part in ALIS was 0.5 of a grade going from A-level mathematics to AS-level further mathematics (based on 1241 students), and 0.6 of a grade going from the A-level mathematics to A-level further mathematics (based on 455 students).

Comments from school staff and lead centre tutors also highlighted the benefits of study days, bringing together students from different institutions.

> *"The boys and girls who would take up this course are usually the best in the school and they know that they've always been the best in their year. But then when they go out into the world they see people who are even better than them at mathematics and it takes them onto another level."*

> *"That has been the most enjoyable part of the project so far for me to bring them together, to see them develop as a sort of little mathematical community. You've got kids who are in schools who are pretty ashamed to be good at Maths. If you're in a school like this you wouldn't make a big fuss about being good at Maths, because you would be a social outcast ... So bringing them together and seeing that there were people like them in other schools was really nice. They got on."*

> *"I had a lot of fun whilst enjoying mathematics. I met new people and new friends and overall, I loved the experience. It became the highlight of my week."*

Wider benefits

One of the wider benefits of the project for students was the encouragement of independent study amongst students.

> *"(The student has) actually grown up an awful lot because of this independence that he's had and because he's had to take charge of his education. He's had to do an awful lot of independent learning. It's been very much a university education in that he's had all the books and been told to get on with it and work from the books. It has been difficult for him but he's then got the confidence to know that he can go on and do whatever he wants if he turns his mind to it and he can go on to whatever."*

> *"It's also helped some of them with individual study, getting them ready for the university years coming up, because they've had to learn self reliance and self organisation ... One or two Heads of Departments have said 'It's widened my lad or lass's perception of what life at university is about', and it's helped them to mature and raise their horizons."*

> *"At the beginning of the year I found it very difficult as I was not used to teaching myself new concepts, but after a couple of weeks of hard work, I learnt how to study more quickly and efficiently."*

In addition to possibly benefiting the students' future study at university, the universities involved in the project have also benefited from widening the participation of students.

"I think the university is considered to be a bit aloof by the local population and our average (of enrolling local students) is not good at Maths. So this has been a really positive example…"

"I'm on the (University) Widening Participation Group, and at the moment, it looks like Maths has had the biggest increase in their students from non-traditional backgrounds or low participation backgrounds. Nearly all of them, the students come in from schools like this and other ones have been part of the project…"

Supporting the project

The evaluation of the 'Enabling Access to Further Mathematics' project also focussed on how the project was run, i.e. how students and schools/colleges were supported in their participation of the project by lead centres and by MEI themselves. In general, the attitudes of schools and colleges were positive towards this support (**Table 5**).

Table 5: Responses of schools/colleges to 'How would you rate the following MEI resources?'

	Web-based materials	Study days	Lead Centre tutorial support
Very Good	3	9	10
Good	5	-	-
Satisfactory	1	-	-
Poor	-	-	-
Very Poor	-	-	-

Although there were some suggestions for improvements to the web-based resources (e.g. to cover more materials, to be more generic for other syllabuses), the schools and colleges that used the resources to supplement their mathematics teaching[3] and the students that took part in the project viewed the resources positively (**Table 6**).

Table 6: Responses of schools/colleges and students to 'How would you rate the web-based resources?'

	Schools/colleges	**Students**
Very Good	11	6
Good	18	6
Satisfactory	2	2
Poor	-	-
Very Poor	-	-

The lead centre support of institutions and students, and the study days supplied by tutors, were once again viewed positively in the questionnaires (**Table 7**).

Those involved in the project therefore viewed the support mechanisms for the project positively. An interesting issue that emerged from the findings though was the practicalities of how this support was delivered, especially in terms of how tutorial support was provided to students. Student questionnaire responses showed that support was mainly provided through visits to and from the lead centre tutor and through e-mail contact (**Table 8**).

[3] This question was only asked of the schools and colleges that were using the MEI web-based materials to supplement their teaching, not those taking part in the distance-learning project.

Table 7: Responses of schools/colleges and students concerning lead centre support

In general, was the Lead Centre support sufficient to run the course properly?		
(Responses from schools/colleges)		
	Definitely Yes	9
	Generally Yes	1
	Not Really	-
	Definitely No	-
In general, how would you rate the tutorial support?		
(Responses from students)		
	Very Good	7
	Good	1
	Satisfactory	3
	Poor	1
	Very Poor	-
In general, how would you rate the study days?		
(Responses from students)		
	Very Good	6
	Good	4
	Satisfactory	-
	Poor	-
	Very Poor	-

Table 8: Questionnaire data on how students accessed tutorial support

How did you access Lead Centre tutorial support? *(Please tick all that apply)*		
(Responses from students)		
	Telephone	4
	Email	10
	Fax	1
	Video conferencing	3
	Visits to tutor	6
	Visits from tutor	13

Indeed, some of the comments from tutors, teachers and students indicated a preference for face-to-face sessions between tutors and students.

> *"I would (have liked) to have an input, say half an hour, fortnightly, when you introduce a topic … I think it would have eliminated some of the problems, it's a fixed amount of time but it's probably better spent, and with the students I've seen it probably would've worked better."*

> *"I thought I had to do mostly all the work on my own, but having direct access to my tutor and having visits to (the lead centre) and tutorials in school has worked well."*

This regular face-to-face contact could prevent some possible issues with the distance-learning project such as motivational problems amongst students. This preference for face-to-face contact was in contrast to interviewees' attitudes towards video-conferencing with students. Although there was recognition that video-conferencing might be preferred to support students in schools and colleges that were at some distance from the lead centres, the tutors would rather have met directly with students.

"I was quite wary of having to do video-conferencing and teach a whole load of new material, it wasn't new material but you know it was different. So it just so happened all the schools were concentrated in terms of the geography so I made a decision right from the start I would do school visits in the first year of actually teaching."

"I really got to know the students and it really helped, they just get the benefits of face-to-face which is, I think, much more preferable to video-conferencing. Next year I am going to experiment with some video-conferencing because there are some schools which are just too far to go to who want to get involved."

Tutors also raised particular problems that they had encountered with video-conferencing.

"(In the first institution), when we got the technical bits right, settings and all that sort of 'techy' things sorted out, we established contact beautifully ... Up at (the other institution), they decided they would use their existing facilities. Now their existing ISDN line involved something called a gateway ... They would have two or three points in the college linked to their ISDN line but it would all be fed through one gateway, one major link, and our impression was that they never actually got it right in the sense, that the signal was always poor and the thing was always either breaking up sound-wise…"

"I looked into video-conferencing and found that would be difficult based at my end, because of the network and all the problems with firewall and stuff. You know, at peak times, it really slows down ... and not having the compatibility between networks as well."

The issue was also raised that video-conferencing could only be used with a few students at a time, and not with the larger groups that some of the lead centres were working with.

Issues and difficulties

In addition to the particular difficulty with video-conferencing highlighted above, the evaluation raised other issues concerning the project. Converse to the benefits for university-based lead centres that were raised above, there were also possible difficulties for non-university lead centres such as the perception of schools or colleges supporting other schools or colleges.

"If you're a school who wants to teach Further Maths to some kids in another school, they will not like that. But if you can say it's under the auspices of (a university) then that's ok."

Also, in contrast to one of the university lead centres using widening participation funds, there was the difficulty of non-university lead centres funding the project.

"I think we were looking ahead to the future and the writing was on the wall for us as being a Centre ... because we can't make any financial commitment

whereas the Universities have little pockets of money which they can call on at different times and it's good PR."

With other issues such as availability of resources and facilities and time constraints on staff, it was perceived that it would also be easier for universities to be lead centres.

The issue of funding is an important one, especially when we come to consider the future viability of the project. One lead centre contact felt that the centres needed to finance the project in its initial stages so that numbers of participating students could be built up. Comments from lead centres indicated that money from the Excellence in Cities and Gifted and Talented initiatives would be required so that sufficient funds would be available for the required lead centre support.

"I've been talking to them independently and they can only continue with the project if they get the money from Excellence in Cities ... I don't want to leave the students high and dry but if they want the project to continue, I think they're going to have to put their hands a bit deeper into their pockets."

"I don't know whether there is ever going to be pressure to break even, because it doesn't matter how many students you've got, unless they get to be in large groups in which case the schools should be running it themselves. That 45 to 50 minutes per student is going to stay, so the extra schools, that's going to mean you're going to have to drive round to them or you're going to have to video-con them in different schools from each other ... It's never going to break even unless you just happen to be lucky and the students come from places where there is a Gifted and Talented (G&T) situation through Excellence in Cities and they are actually happy to let you have extra support funding through G&T."

The views of the schools themselves who were interviewed were varied with regards to funding. One felt that additional funding was required for areas such as managing the project within schools and providing transport for students, but another felt that the funding from the Learning Skills Council alone was sufficient. Questionnaire responses from schools and colleges indicated that approximately a third of them found the project 'moderately demanding' on their resources (**Table 9**).

Table 9: Demands on school/colleges' resources

	Extremely Demanding	Moderately Demanding	Undemanding
Academic support for FM students	1	3	6
Emotional support for FM students	-	1	9
Associated project administration	-	3	6
Associated project costs	-	3	5

A possible area of difficulty that was raised for the students involved in the project was that additional workload that the project entailed. One school raised the issue of students 'not coping' with the distance-learning aspect of the project.

"The distance nature of it, I think that some of them just aren't mature enough to cope with that. They've got good intentions but they never quite get round to going on to the website, they'll probably go on to the computer, they might even go on to the internet but getting on to that actual website to do some work doesn't

quite happen. Some of them just felt that they couldn't do it that way, they said if we offered it taught they would manage it but they couldn't do it on their own."

Looking at the questionnaire responses from students (**Table 10**), they seemed to be an even split between those that preferred or did not prefer the distance-learning method, although the respondents generally felt that they had coped well with their course.

Table 10: How students felt about the 'self-study' course

How have you coped with the 'self-study' style of the MEI course?		
(Responses from students)		
	Very well	5
	Generally well	7
	It's been difficult at times	1
	Not very well	1
How did the 'self-study' style of learning compare with the more traditional classroom-based approach?		
(Responses from students)		
	Definitely better	3
	Generally better	3
	About the same	1
	Generally worse	3
	Definitely worse	3

Future development of the project

The final theme arising from the findings was the possible future development of the 'Enabling Access to Further Mathematics' project. One possible development that was raised in the interviews and in the questionnaires to schools and colleges was the expansion of the distance-learning materials to cover a number of syllabuses, and perhaps use them for different age groups.

"I think where the MEI project will go will be, and I know it is going that way, is that the resources will get bigger and better and probably more generic. ... I think it will start to become valuable for the accelerated pupils that are taking their GCSE's at the end of Year 10."

Another possible suggestion was the use of 'sub-centres' or 'cluster centres', where students are brought together from different schools and colleges. This would enable tutors to provide face-to-face support to larger numbers of students, therefore coping with larger students numbers as well as making the project more financially viable. The lead centres could also use additional personnel to help with this support.

"If I hadn't got a colleague from (a neighbouring university) joining me in the autumn, we'd now be completely swamped ... I mean you're swamped with over fifteen kids if you're on your own, let's be straight about that. So I mean I would question anybody who reckons they can do more than fifteen kids unless they're in big groups and it's virtually their only job."

"I think we need to look at different models, one of which might be using retired Maths teachers. So the model might be I do some teaching but also part of my

job is also to find good Maths teachers who are now part-time, who would enjoy having little Further Maths classes here and there and doing something like that. That's how I imagine it might work if it got any bigger."

5. Discussion

Based on the emerging themes from the findings, we can highlight what worked and make suggestions for the future development of the 'Enabling Access to Further Mathematics' project.

The evaluation has identified definite benefits brought about by the project. It provided students with the opportunity of studying Further Mathematics and enabled mathematics departments to offer this to their students. The additional benefits for students were the knock-on effect on their single mathematics, and a possible increase in their independence in studying, brought about by the distance-learning nature of the MEI course. There were also benefits suggested for the university-based learning centres, in terms of widening participation and increasing their profile in their local areas.

In addition to identifying the possible benefits, we were also able to examine how well the project ran. In terms of the support provided by the lead centres to students and the schools/colleges involved, the perceptions of those involved were positive (see **Table 7**). A particular issue that emerged from the evaluation was how one could provide this support. There were preferences expressed by tutors and teachers for face-to-face support for students by teachers, and additional benefits were identified for study days that brought together students from different institutions. Looking to other studies, Tanner and Jones (2000) also highlighted a preference for face-to-face support when they examined the views of PGCE students taking part in a distance-learning initiative. In their case, this preference arose from a perceived lack of camaraderie between peers in the initiative, and a lack of learning opportunities that could be gained through face-to-face interaction with tutors and fellow students.

Possible difficulties were also identified for non-face-to-face support, in particularly for video-conferencing where problems with links and restrictions on student numbers were identified. A particular study that examined the use of video-conferencing in teaching and learning was carried out by Knipe and Lee (2002). They agreed with Tanner and Jones above in that some of their conclusions were that video-conferencing did not provide the same opportunities for group-work as face-to-face support, and that there was not the mixing of different students in order to explore and generate new ideas. We saw from **Table 8** that support contact by e-mail certainly had its place in the project, and there may be instances, for example for schools or colleges at some distance from lead centres, where support by video-conferencing is required. Also, we must be careful not to draw conclusions that are too general from the small samples of lead centres and schools/colleges taking part in the pilot project. However, what the evaluation highlighted was the importance of face-to-face support in this project and we would encourage MEI and lead centres to bear this I mind when considering the future support for the project.

A possible restriction however on this face-to-face support of students may be the financial implications of providing this support, in terms of it being more staff-intensive. As a result, we must consider how the project can develop and expand, bearing this restriction in mind. Suggestions were made in the evaluation of taking on additional persons to provide support, for example retired mathematics teachers. However, this alone will not solve the possible funding problems; rather, this must be accompanied by an increase in student

numbers. An interesting suggestion made in the evaluation was the use of 'cluster' or 'sub-centres' where larger numbers of students can be tutored together. This is therefore another avenue that can be explored by MEI and lead centres. There was also a suggestion in the evaluation that the financial constraints may be more flexible for university-based lead centres, with their access to additional funds and the obvious benefit of widening participation. Therefore, if the project is to be rolled out and new lead centres brought into the project in the future, then these possible advantages for universities should also be considered. A final financial issue that should be considered by MEI and lead centres is the possible need for some schools and colleges to apply for funds from sources such as Gifted & Talented and Excellence in Cities. This additional funding may be helpful for institutions to cover their costs to support the project. Although this may not be required by all those taking part in the project, it is suggested that MEI makes sure that this is clear for schools and colleges enrolling in the project.

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References

Heard, T. (1998) *Encouraging Further Mathematics: A discussion paper*, available online at http://www.m-a.org.uk/education/taking_maths_further/encouraging_further_mathematics (last accessed 6th October 2003)

Issroff, K. and Eisenstadt, M. (1997) 'Evaluating a virtual summer school', *Journal of Computer Assisted Learning*, **13**, pp. 245-252

Knipe, D. and Lee, M. (2002) 'The quality of teaching and learning via videoconferencing', *British Journal of Educational Technology*, **33**, 3, pp. 301-311

London Mathematical Society/IMA/RSS (1995) *Tackling the Mathematics Problem*, London: LMS

Stripp, C. (2001) 'The Crisis in Further Mathematics and how MEI and Gatsby are working to address it', *Teaching Mathematics and its Applications*, **20**, 2, pp. 51-55

Tanner, H. and Jones, S. (2000) 'Using ICT to support interactive teaching and learning on a Secondary Mathematics PGCE course', paper presented at the British Educational Research Association Conference, September 2000, Cardiff, UK. Available from: http://www.leeds.ac.uk/educol/documents/00001628.htm [Accessed 29th October 2003]

Williams, P. (2002) 'The learning Web: The development, implementation and evaluation of Internet-based undergraduate materials for the teaching of key skills', *Active Learning in Higher Education*, **3**, 1, pp. 40-53

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