THE IMPACT OF TRAINING COURSES ON MATHEMATICS TEACHERS' USE OF ICT IN THEIR CLASSROOM PRACTICE

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Are teachers more likely to incorporate ICT in their teaching if they have done (a) a training course that is specifically devoted to exploring ICT packages to use in the classroom or (b) if they have done a training course that incorporates ideas for using ICT as part of a course focused on developing specific subject knowledge and pedagogy? As a significant provider of professional development for post 16 mathematics teachers in England, the Further Mathematics Support Programme reflects on the impact of their training courses on teachers' use of ICT in the classroom.

INTRODUCTION AND CONTEXT

The Further Mathematics Support Programme (FMSP), managed by Mathematics in Education and Industry (MEI) has been working to ensure universal access to a pre-university qualification in Mathematics in England since 2005. An Advanced Level General Certificate of Education (GCE), commonly referred to as an A level, is a pre-university qualification offered by schools and colleges. A levels are typically required for a student to gain entry to a university. Mathematics is unique in that there are two A levels available for students; A level Mathematics and A level Further Mathematics. However, many schools were unable to provide access to the latter. One reason for this was the shortage of teachers with appropriate skills at this level. Since the inception of the FMSP in 2009, the number of students studying A level Further Mathematics has risen by 125%, which has further increased the demand for teachers to acquire the necessary skills and experience to teach mathematics at this level.

The FMSP runs an extensive programme of professional development courses aimed at both improving teachers' subject knowledge and developing pedagogical skills. Each year approximately 2000 teachers take part in FMSP training courses.

The FMSP's training courses broadly fall into one of three types: a one day course, a series of live online sessions lasting 10 hours and a 14 month programme which includes four one-day courses and a series of online sessions. The amount of ICT that course tutors use in these courses varies greatly. In particular, in the courses where ICT is used, the FMSP is interested to find out which type of training course has the greatest impact on a teacher's use of ICT in the classroom. In 2012, approximately 90% of teachers who enrolled in the FMSP's programme of professional development took a one day course.

This paper looks at the impact of incorporating ICT into our one day courses which we have divided into two types: training courses that are specifically devoted to exploring ICT packages and training courses that focus on developing specific subject knowledge, incorporating ideas for using ICT.

OBJECTIVES OF THE RESEARCH

This research is focusing on one day stand-alone courses. Approximately one tenth of these one day courses each year are devoted specifically to training teachers to use maths specific ICT software and hardware, for example graphing calculators, Geogebra and Autograph. In addition, approximately one fifth of the one day courses have significant elements of ICT embedded within

the subject knowledge focused content. Whilst the content of these days is driven by the need to improve subject knowledge and associated skills of the delegates, ICT is sometimes incorporated where it may illuminate the mathematical concepts, with the aim of improving teachers ICT skills and confidence so that they may be more willing to incorporate it in class.

In cases such as this, there is emerging anecdotal evidence that our courses not only support subject knowledge and pedagogy but also build confidence for teachers to engage with the use of maths specific ICT without explicitly aiming to do this. Thus, the research question for this work was – Are teachers more likely to incorporate ICT in their teaching if they have done (a) a training course that is specifically devoted to exploring ICT packages to use in the classroom or (b) if they have done a training course that incorporates ideas for using ICT as part of a course focused on developing specific subject knowledge and pedagogy?

METHOD

Twenty one-day courses, scheduled in 2012 were identified. One half of these courses, attended by a total of 108 delegates, were specifically focused on ICT. The other half, attended by 115 delegates, were courses where ICT was incorporated but not the main focus.

Of the ten courses that specifically focused on ICT, seven focused on Geogebra, one on Autograph, one on graphing calculators and one looked at a variety of ICT applications in a teaching context.

Of the ten courses where ICT was not the focus, nine of the courses were supporting Pure Mathematics topics, and one course focused on Statistics.

Practising teachers who had attended these courses were contacted by email and invited to complete an online survey about their use of ICT with post 16 mathematics classes. For the purpose of this study, the teachers were instructed to consider their use of maths-specific software or hardware such as graphing calculators, CAS calculators, spreadsheets, dynamic geometry software, graphing software but not to include the use of an interactive whiteboard, Powerpoint, scientific calculators or Maths websites.

Key questions in our survey asked teachers to describe their practice before and after their course. In particular, we asked them to indicate the frequency with which they used ICT in their lesson preparation, used ICT to demonstrate in class and gave their students opportunities to use ICT in class. We also asked teachers a direct question about whether as a result of attending, the course had changed the amount they used ICT in their teaching.

SUMMARY OF FINDINGS

We received responses from 39 of the 108 who attended courses specifically for ICT and 32 of the 115 who attended courses where ICT was incorporated. A summary of the responses to the key questions is shown in the tables below. The first two tables indicate teachers' responses when asked to describe their practice in three areas, prior to and after the course.

	I use ICT in my lesson preparation		I use ICT to demonstrate in class		My students use ICT	
	Prior to the course	After the course	Prior to the course	After the course	Prior to the course	After the course
every lesson	25.6%	25.6%	15.4%	15.4%	5.1%	5.1%
at least once a week	35.9%	43.6%	35.9%	51.3%	7.7%	17.9%
once a month	15.4%	17.9%	30.8%	25.6%	30.8%	43.6%
rarely	23.1%	12.8%	17.9%	5.1%	51.3%	30.8%
never	0.0%	0.0%	0.0%	2.6%	5.1%	2.6%

Table 1: Comparing responses from 39 teachers on ICT specific courses about their use of ICT before and after their training course

	I use ICT in my lesson preparation		I use ICT to demonstrate in class		My students use ICT	
	Prior to the course	After the course	Prior to the course	After the course	Prior to the course	After the course
every lesson	40.6%	43.8%	18.8%	18.8%	0.0%	0.0%
at least once a week	28.1%	28.1%	31.3%	46.9%	18.8%	28.1%
once a month	15.6%	15.6%	37.5%	25.0%	15.6%	21.9%
rarely	15.6%	12.5%	12.5%	9.4%	56.3%	43.8%
never	0.0%	0.0%	0.0%	0.0%	9.4%	6.3%

Table 2: Comparing responses from 32 teachers on ICT incorporated courses about their use of ICT before and after the training course.

Table 3 indicates teachers' responses to the direct question asking them whether as a result of attending, the course had changed the amount they used ICT in their teaching.

As a result of this CPD course I have used ICT in my teaching...	much more than before	slightly more than before	about the same as before	slightly less than before	much less than before
Courses that are specifically ICT based (39 responses)	7.7%	51.3%	38.5%	0.0%	2.6%
Courses incorporating ICT (32 responses)	0.0%	34.4%	65.6%	0.0%	0.0%

Table 3: Comparing responses from the two groups

DISCUSSION AND CONCLUSION

Comparing the results in tables 1 & 2

Looking at the responses for lesson preparation it can be seen that some of the teachers on the ICT specific course indicated that they were more likely to use ICT in their lesson preparation after attending the training. However, from the results in Table 2, it can be seen that teachers who attended an ICT incorporated course indicated that there was little or no impact.

In both groups there was a slight increase in the number of teachers using ICT to demonstrate in class. The ICT specific group seem to have a marginally greater increase.

Some teachers on the ICT specific course indicated that they were more likely to involve students in the use of ICT through student-centred tasks after attending the training. However, from the results it can be seen that teachers who attended an ICT incorporated course again indicated that there was little or no impact.

The results in Table 1 and Table 2, although comparing the overall differences for each group, only provide a summary of each of the two groups as a whole. Table 4 breaks down the responses in order to ascertain to what extent each teacher's practice had increased, stayed the same or decreased after the course.

By considering the changes in practice of individual respondents shown in Table 4, it can be seen that that there was no change for the majority of teachers in all categories in the amount they used ICT in the areas surveyed. However we do note that for both types of course there has been a shift towards more student use of ICT in class and that this is slightly more marked among the group who attended the ICT specific courses.

From this it appears that the impact of a one day course, albeit ICT focused or incorporated, is limited. Crisan said "teachers' own learning experiences with ICT is of paramount importance in their uptake and implementation of ICT, more powerful than simply adopting the resources and ideas presented to them by others or acquired through attending professional development programmes, for example" (Crisan, C.: 2008)

However, when we consider the results in Table 3 reporting the teachers' perception of the impact of their training it appears to contradict the evidence. More than half of the teachers that attended the ICT specific course and approximately one third of teachers who attended an ICT incorporated course perceived that there had been an impact on their practice as a result of the training but this is

not really supported by the analysis in Table 4. Overall teachers seem to overestimate the value of a one day course on impacting on their use of ICT in the classroom.

After attending the course…	I use ICT in my lesson preparation		I use ICT to demonstrate in class		My students use ICT	
Increase	17.9%	9.4%	25.6%	15.6%	33.3%	28.1%
Stayed the same	82.1%	90.6%	71.8%	84.4%	64.1%	71.9%
Decrease	0.0%	0.0%	2.6%	0.0%	2.6%	0.0%
	Courses that are specifically ICT based (39 responses)	Courses with ICT incorporated (32 responses)	Courses that are specifically ICT based (39 responses)	Courses with ICT incorporated (32 responses)	Courses that are specifically ICT based (39 responses)	Courses with ICT incorporated (32 responses)

Table 4: Comparing the three questions about how individual responses have changed after the course, for the two types of course

It appears that the courses impact slightly more on teachers who have chosen the ICT specific courses however the sample may well be self-selecting as these teachers have chosen to do an ICT course so we would expect them to be more receptive to the ideas. Teachers on ICT incorporated courses may well be less receptive as their primary purpose in attending the course will usually be to improve their subject knowledge in a specific area of mathematics rather than developing their ICT skills. They may also be less inclined to use ICT when they return to the classroom if they are just becoming confident with the mathematical concepts of the units they are teaching.

A longer study would be needed to ascertain whether any increase was sustained and whether it had impact beyond the A level classroom.

On the basis of this research and our extensive work with teachers, we suspect that the type and length of course that we offer may have an influence on the extent to which a teacher's engagement with math specific ICT has an impact on their practice. The FMSP's Teaching Further Mathematics course, which runs for a full year, has maths specific ICT embedded throughout. Teachers have access to Autograph, Geogebra and Graphical calculator emulators and are given opportunities to use the technology alongside learning the mathematics.

In 2011 the JMC produced a report which stated "The development of electronic professional development resources for teachers, possibly offered as e-CPD' is an approach that has been explored (but not exploited)…" (Digital technologies and mathematics education, Joint Mathematical Council (2011), Pg 26)

The Live Online Professional Development (LOPD) programme (de Pomerai, Tripconey 2009 and 2011) offers e-CPD courses which are both ICT specific and have ICT incorporated. The online sessions are recorded giving teachers the chance to revisit and refresh their knowledge allowing them more opportunity to embed the skills within their teaching.

It is our intention to continue this research to try to measure the impact of ICT training delivered in the FMSP's extended and online courses.

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