A Reflective report which discusses the key issues related to the effective use of ICT to support mathematics in the primary classroom.

Information and Communication Technology (ICT) is developing at a rapid rate in our society. Due to this, it is vitally important that children are taught ICT skills in school. ICT includes computers, tape recorders, videos, television, the internet and many others. It is only recently – due to the Dearing Review (1994, cited by Briggs & Pritchard, 2001), that ICT has been seen as a subject in its own right. Since 1997, the Government has promoted a succession of initiatives intent on raising the use of ICT in schools. This has included training, funding for resources and documents to support teachers in the effective use of ICT.

The National Curriculum is now promoting the importance of ICT across the curriculum and how it can be used to support other subjects, especially maths. In maths there are several links that can be made to ICT (Appendix A). This supports the Primary National Strategy's ideas of promoting a broad and balanced curriculum. Throughout this essay I will investigate key issues relating to the effective use of ICT to support children's learning and teaching in maths.

The third International Maths and Science Survey (TIMSS) state that there is little hard evidence for the beneficial effects of ICT, although there is a suggestion of a possible negative effect (Higgins 2003, p170). The impact2 study (Harrison et al 2000) supports this. They found that there was no link between resources of ICT and maths at key stage 1 and only a small association at key stage 2. However other initiatives have shown to be effective such as peer tutoring, reciprocal teaching and homework.

Although evidence does not prove that ICT will raise attainment, it does highlight how teachers can raise attainment when they use ICT to support their teaching of numeracy (Moseley et al 1999). The key here is the teacher. Williams and Easingwood (2004) agree stating that the use of ICT cannot replace the teacher – 'the key lies in how the technology is used and employed, not in the teaching and the technology itself' (p9), the teachers role therefore is crucial. As teachers we need to make judgements about when and how to use ICT (Mosely et al 1999), we need to consider the purpose, range and style of software that is available. I will look at the research evidence and discuss the way that ICT can be used to enhance teaching in the classroom

The DfEE state 3 key principles underpinning any decision to use ICT in maths: ICT Should enhance good maths teaching, should be linked to the mathematics learning objectives and should only be used if the teacher and/or children can achieve something more effective with it than without it. (DfEE, 2000, cited by Briggs & Pritchard, 2002). This highlights the need for good planning where the needs of all the learners in the class are met. In Mosely et al's (1999) study of

counting skills in reception, he found that carefully planned and structured ICT activities with a clear mathematical objective, can play an effective role in improving pupils counting skills. Planning is therefore vital. Teachers need to be aware of children's prior learning and plan for the individual children they have in their class.

However teachers are often restricted and cannot always teach what they wish. Medium term and long term planning mean the curriculum is mapped out months in advance. This is important as it ensures progression and continuity, although it does put restraints on teachers planning. Although this is the case, Excellence and Enjoyment highlight the freedom that teachers have, reminding us that the Numeracy strategy is not statutory and the National Curriculum only tells us what to teach, not how (Appendix B). And it is how we teach that influences how effective ICT is used to support children mathematical skills. There is a large amount of research that suggests how ICT should be used in maths; I will focus on the most effective uses below.

Williams and Easingwood (2004) refer to ICT as a 'value added component'. ICT can act as a tool to harness children's mathematical learning. In many cases it can allow children to perform tasks quicker such as drawing graphs, so that more time is spend on high order skills such as analysis and interpretation. Although this is the case there is a big debate on how far the use of technology should be permitted to replace manual skills, which is highlighted in the 2003 Becta report. (Appendix C). Williams and Easingwood (2004) state that ICT should never replace practical maths. I agree, I am very aware from personal experience of learning and teaching as well as through reading and discussing that children learn a lot more by 'doing'. The most powerful use of ICT seems to occur when practical activities are supported by the use of application software such as databases and spreadsheets.

The use of calculators is at the centre of the debate regarding how far technology should replace manual skills. The use of the calculator is virtually non-existent in many classrooms due to the fear that children will not calculate the answers themselves. There is conflicting evidence regarding the use of calculators. The Numeracy Task Force 1998 (cited by Williams & Thompson, 2003) stated that calculator usage should be restricted until the age of 8 or 9. This was supported by the DfEE in 1999 in '*The framework for teaching maths from reception to year 6'* which stated that calculators should not be used at key stage 1. Although they did recognise that if used well calculators can be an effective tool for learning about number. Thompson & Williams (2003) state that calculators can be used to help children's mathematical development in 2 ways – as an 'aid in problem solving' and as a 'teaching aid' (p156). Calculators can be used very effectively; they can help children understand the function keys and can stimulate them to use large numbers. We must also not underestimate the knowledge and understanding developed when 'playing' with calculators. Many theorists assume that children need to learn the skills to use a calculator before

using it, however, by experimenting they begin to 'embed and extend their developing ideas about number' (Williams & Easingwood, p35). My experience supports this as the class I was working with loved the challenge of finding different numbers and began to make patterns and explore place value. Again it is a question of using ICT to enhance the teaching and using it where appropriate, being clear about what you want the children to learn.

Research has also shown how ICT can be used as a teaching aid and help the teacher 'focus the children's learning'. The Interactive Whiteboard is a key resource which does this. It allows teachers to present information in a range of ways so that children of differing abilities and learning styles can understand. In my experience it makes learning more fun and Interesting for both teacher and the children. It also allows children to be involved and interact with the learning; one example of this is the highlighting tool. It is this level of integration, according to Williams and Easingwood (2004), which makes this a powerful tool for both teacher and child (p59).

It is clear that children pay more attention if the lesson is interesting and fun for them as they are more motivated to learn. Motivation is a key factor in learning as children will only learn if they want to. Linking learning to children interests and their lives is very important, especially with boys. 'The use of real data collected from a real medium can both be more interesting for children and serve as a motivating factor in their work.' Briggs and Pritchard (2001,p5). Using television programmes, the internet and teletext can be a very good way of enhancing children's learning, providing a context in which they can use their skills. This is very important in maths as it's an abstract subject and children can find it very difficult to establish concrete ideas.

ICT has been shown to develop collaborative learning and therefore develop mathematical language and learning. The Cockcroft report, 1982 (Appendix D) stresses the importance of discussion and of using the correct mathematical language. Children often get confused due to its ambiguous nature and so it is essential that children are taught the correct terminology at an early age. Computers encourage pair and group work and much software is aimed at collaborative work. Children in most schools have to work together due to the limited amount of computers, but this can be used as an advantage. Wegerif et al (1998) agrees stating that direct software can support discussion and reasoning. He found that the intervention could move classes from 50th out of 100 to the top 30. He believed that software needs to challenge, have a clear purpose, on screen prompts, no features that encourage turn taking and multiple choice questions. (Higgins, 2004, p170) There is a lot of evidence that shows the effectiveness of discussion and peer support. Vgotsky states that with the help of their peers children enter into a 'zone of proximinal development' which allows them to achieve their full potential.

However some software is better suited to individual learning, allowing children to work at their own pace. Jackson and Kutnick (1996, cited in Higgins 2005) agree stating that 'Individuals

work better on drill and practise activities'. Integrated learning programmes are an example of this and can be very effective as they are differentiated and provide feedback for children. This 'drill and practice' software allows children to practice the skills they have learnt; the Cockcroft report highlights the importance of this. However the integrated learning programmes don't ensure that pupils are learning the desired objective and don't offer formative feedback. Therefore it does not help children to improve and correct their answers and this is a crucial part of the learning process.

The area where ICT can be used very effectively in maths is experimental learning, where the role is reversed and children 'teach the computer'. Much research states that when children explore and experiment for themselves they truly learn. As teachers we need to be aware of children's capabilities and allow them to explore. Williams and Easingwood (2004) state that 'a good teacher is often a teacher who is prepared to take risks' (p36). Ownership can be liberating for children and gives teachers new insights into the way children learn. Also if willing, teachers can learn a lot from the children. They often know a lot of the software better than due to being brought up on computers. This can be a good opportunity for children to teach the class, or tutor their peers, and this has been shown to be a very effective way of supporting children's maths skills, as it allows them to explain their ideas of skills and concepts, which consolidates their learning.

Similarly teachers need to be aware that children do not have to know everything. Ainley (2001, p172) states that children will learn more by working through their problems and learn valuable lessons in problem solving. From my work in year one I am aware of the importance of problem solving, the Cockcroft report reinforces this calling problem solving 'the heart of mathematics' (Appendix B). Seymour Papert (book mindstorms, 1980) was geared towards experimental learning rather than directly instructing the children. He came up with the program 'logo'. Logo allows children to explore and through this they begin to understand instructions and how to program the turtles to do what they require. Logo can enhance children's skills in several areas of maths including: shape and space, direction, distance, angles, bearings and compass points. It allows children to learn advanced concepts such as angles; this is where logo is so powerful. Angles could not be taught at a very young age but through logo children become aware of 90 degree and 180 degree angles, which is a concept way advance of their years. Logo can also offer lots of extension activities such as: producing the same results with further commands and a move to formulas. This will make sure that learning is not restricted and 'more able' children are catered for.

ICT can be used effectively to differentiate pupils. The teacher can harness the children's abilities in one area to help them with difficulties in another. Williams and Easingwood (2004) state that what remains important is that the ICT being used is appropriate to the capabilities of the pupils and the teaching and learning objectives for that lesson. Many children find maths difficult

and ICT can be used to increase their confidence and motivation. In my experience ICT is fun for children and they often do not realise they are learning. ICT can support children of differing abilities. ICT equipment can be modified to suit the child, for example a different keyboard could be used to support those with weak motor skills or a larger screen for visually impaired children. It is crucial that all children are included and treated as individuals so that they can achieve their full potential. This is a requirement of the National Curriculum (Appendix E), which reflects the Education and Human Rights Act.

ICT provides a wealth of tools for teachers to enhance children's mathematical skills. The evidence clearly shows that it is how ICT is used that makes the difference. A lot of factors affect the way that teachers teach. Higgins and Moseley (2001) state that the way in which teachers skills, beliefs and practices are related, affects the way they choose to use ICT, and how effective they are at using it. Pritchard and Briggs (1996) support this stating that recent research (NGfl, BECTa, Dfes, 2001) has found that the extent of ICT use in the curriculum seems to be dependent on the individual teacher and that pupils can have very different experiences across different schools and subjects

Mosely et al's (1999) document 'moving forward with ICT…' states that this is more to do with teacher confidence. They found that finding areas of ICT where teachers are confidence was a great starting point. This made them more likely to try new teaching approaches, resulting in the effective teaching of ICT. Ainley (1996) agrees stating that 'developing your own confidence with using mathematical software is a very important step towards using ICT confidently to enrich children's experiences of mathematics' (p4). This highlights the support that teachers need - support from colleagues, the school and the Government.

The Government have created a range of initiatives to support teachers. One of the Governments initiatives funded by the New Opportunities Fund (NOF) in 1997 was to provide new equipment and resources to teachers. More recently laptops have been provided for teachers to plan and preparations have been made for broadband to be available in all schools. This has shown to be effective. The teacher training Agency evaluated the use of training and found improved standards of attainment. This is supported by the annual ofsted report 'ICT in schools' (2004) which states that 'overall an increasing number of numeracy lessons are being supported by ICT'. However, the lessons were shown to be inconsistent and unsystematic. These concerns are shared by the Becta Report (2003), although they state that it may be due to the variable access to ICT. Either way, these inconsistencies are causing inequalities in maths and this is something that has to be addressed. This shows we still have a long way to go.

Word Count - 2182

Bibliography

Ainley, J (1996) *Enriching Primary Mathematics with IT*. London: Hodder & Stoughton.

Ainley, J (2001) Adjusting to the newcomer, roles for the computer in mathematics classrooms. Gates (ed) *Issues in mathematics teaching*. London: Routledge Falmer

Briggs, M & Pritchard, A (2001) *Using ICT in primary mathematics*, Exeter: Learning Matters.

Cockcroft, Dr W H (1982) *Mathematics Counts*: Report of the committee of enquiry into the teaching of maths in schools. London. HMSO.

Department For Education & Employment. (2004) *Excellence and Enjoyment*. London. DfEE.

Department For Education and Employment and the Qualifications & Curriculum Authority. *National Curriculum, key stages 1 and 2*. London: DfEE Publications

Department For Education & Employment. *The National Numeracy Strategy*, *Framework for teaching*. Suffolk: DfEE Publications

.

Higgins (2003) Does ICT make mathematics teaching more effective? Thompson (ed) *Enhancing Primary Mathematics teaching*. London: Open University Press.

Williams, H & Thompson, I (2003) Calculators for all. Thompson. I (ed) *Enhancing Primary Mathematics teaching*. London: Open University Press.

Williams, J & Easingwood (2004) *ICT and Primary Mathematics*. A Teachers Guide. Oxon. RoutledgeFalmer

Reports/journals

Harrison et al (2002) *Impact2: The impact of Information & Communication Technologies on pupil learning and attainment*. Coventry: Becta

British Educational Communications and Technology Agency (2003) What research says about ICT in schools? (online) www.becta.org.uk/research (2.12.05)

Higgins, S & Moseley, D (2001) 'Teachers' thinking about ICT and learning: beliefs and outcomes,' *Teacher Development*, **5** (2): p191-210.

Managhan, J (1998) 'Moving too regular use of ICT in maths classes'. *Micromath*, **vol 14**, no3 p10-14. (01.12.05)

Mosely et al (1999) *Ways forward with ICT. Effective Pedagogy; Using Information and Communication Technology in literacy and Numeracy in primary schools*. Newcastle Upon Tyne: University of Newcastle Upon Tyne.

Ofsted (2004) ICT in schools. The impact of Government initiatives. – www.ofsted.gov.uk

Ofsted annual report, (2004/2005) – www.ofsted.gov.uk

The Primary National strategy- www.standards.dfes.gov.uk/primary/

Appendices

Appendix A –The National Curriculum – ICT in other curriculum areas
- ICT links in maths

Appendix B- Excellence & Enjoyment

Appendix C- 2003 Becta Report

Appendix D- The Cockcroft Report, 1982

Appendix E – The National Curriculum - Inclusion

Appendix A

Appendix B

Appendix C

Appendix D

Appendix E