Evaluation of mathematics curriculum

The question, ‘ Why Teach Mathematics?’ as put forward by Ernest (2000), is one without a straightforward answer. Ernest (2000) outlines many difficulties which must be overcome if mathematics is to be taught effectively, namely the wide-ranging and complex aims of school mathematics (Ernest 2000, 7). The debate continues to rage in the columns of the broadsheets, as to whether the mathematics teaching in this country is effective and indeed whether or not it meets the needs of an increasingly complex society. Furthermore, as propounded by Ernest (2000), should the learners themselves be allowed to opt in or out of mathematics learning by choice?

The first issue to be discussed is the mathematics curriculum itself. Ernest (2000) recognises four main aims for school mathematics and, therefore, the curriculum:

‘ *1 To reproduce mathematical skill and knowledge-based capability;*

2 To develop creative capabilities in mathematics;

3 To develop empowering mathematical capabilities and a critical appreciation of the social applications and uses of mathematics;

4 To develop an inner appreciation of mathematics – its big ideas and nature’

(Ernest 2000, 7)

These four aims represent the need for a demanding and comprehensive curriculum. The mathematics curriculum has undergone radical changes in

recent years, most notably with the introduction of the National Numeracy Strategy in 1998 (DfES 1998). This was followed in 2006 by the renewed Primary Framework for Mathematics (DfES 2006), its aim *‘ to support and increase all children’s access to excellent teaching, leading to exciting and successful learning , ’* (DfES 2006, 1). Throughout the new framework there seems to be an increased emphasis on problem solving (using and applying) and calculating skills, seemingly in accord with Ernest’s views on the matter, particularly in terms of developing creative abilities in mathematics. The renewed framework for mathematics places increasing importance on developing practical skills and, *‘ providing real experiences, context and meaning,’* (DfES 2006, 13), seemingly in line with Ernest’s views.

Consequently, it would seem that the current mathematics curriculum is headed in the ‘ right’ direction. Indeed current classroom practise is a far cry from the traditional mathematics lessons of the past. Teachers are encouraged to think of the needs of all their learners through using a variety of different interactive teaching strategies. Children are challenged and supported to make progress at a differentiated level. Indeed classroom practitioners are expected to include sophisticated differentiation into their short term planning. This should surely mean that the standard of mathematics within schools is improving. This would also seemingly be at odds with the suggestion put forward by Ernest when he asks, ‘ *should the same curriculum be followed by all?’* (Ernest 2000, 8). This would imply that if the same curriculum is followed by every pupil, the needs of every pupil are not being met. However, this is not the way that mathematics should be dealt with in the classroom, as summarised by Wain:

‘ The degree to which the teacher retains control of what the learners do each lesson and the extent to which the learners can choose the next task vary…but typical of all is that learning is individualized to a very great extent, although often within a group setting. Whole-class teaching is, in general, not used, or used sparingly, and each pupil is engaged in a learning process that is unique to him or her.’ (Wain 1994, 136)

The view that modern teaching methods have improved the standard of mathematics learning in this country is not, however, the opinion commonly put forward by many of today’s journalists. Chris Woodhead of the Sunday Times (August 26 th 2007) recently reported that an insufficient number of pupils are obtaining A*-C grades at GCSE level, despite the fact that pass rates are higher than ever:

‘ *Last year 45. 8% of students achieved five A*-C grades including English and mathematics in the GCSE examination: 54. 2% did not. This annual statistic is one that the government was long reluctant to release. In that English and maths are of such crucial importance, it is the only statistic that matters.’* (Woodhead 2007)

These figures would seem to suggest that the teaching of maths in this country, and perhaps the maths curriculum itself is in someway failing the young people who sit their GCSE mathematics examination every summer. However, A*-C are not the only pass grades, and this figures could, therefore, be construed as misleading. Institutes of further and higher education do seem to place emphasis on successful candidates having the required A*-C grade in mathematics, however, is this the most useful way of

assessing how successful an individual will be at higher levels of study, particularly when that individual may not be continuing their mathematics education beyond GCSE level? Indeed Ernest puts forward the idea that, ‘ *mathematical attainment is mistakenly identified with intelligence and mental power and used to grade and select persons for various forms of work, including professional occupations, as well as in terms of suitability for higher education,’* (Ernest 2000, 8).

Consequently it would seem that too much emphasis is placed on achieving desired grades in mathematics at GCSE level. However, the view of employers and those of higher education institutes is unlikely to change until public opinion is revised, after all, ‘ *Yes 98% of candidates are awarded some sort of grade, but everyone knows that any grade below a C is worthless in the real world,’* (Woodhead 2007).

This argument would seem to lead into another suggestion by Ernest (2000, 8), concerning the viability of the current arrangements for teaching mathematics to five to sixteen year olds in a modern environment, ‘ *Requiring learners to study mathematics from the age of five to 16 years is less easy to justify if mathematics is not as useful as is often assumed,’* (Ernest 2000, 8). This could be taken to mean, is mathematics as necessary as we think in order to survive and progress in today’s society? It could be proposed that any number of professions, or avenues of employment, do not require the individual to have mathematical knowledge in order for them to execute their duties successfully. Consequently, it could be argued that individuals should be allowed to, ‘ *opt out altogether,’* (Ernest 2000, 8), if their chosen career path permits it. The difficulty with this route would be

deciding at what point in their education the individual should be allowed to opt out of their mathematical instruction.

On the other hand Orton (1994, 14) expounds at length on the importance of mathematics in the world today:

‘ The indisputable fact is that mathematics is vital to the maintenance of satisfactory living standards. It is mathematics which underpins the science and technology that support modern society. It would seem to be a legitimate aim for educators to wish that pupils will come to an understanding of how society works, and this implies an understanding of how mathematics provides support’ (Orton 1994, 14).

Consequently, it could be said that regardless of whether or not we need mathematics for our employment, it is essential for survival in the modern world. At its simplest level individuals needs a knowledge of money and monetary systems to survive in today’s world, something that is addressed by mathematics teaching. At a more advanced level, as technology advances apace, the individual needs to be equipped to operate it in a variety of different occupations. However, is the mathematics curriculum preparing the individual for this adequately?

Another question to be considered as part of this debate is, ‘ where does mathematics teaching end, and information and communication technology (ICT) teaching start?’ There is surely considerable overlap, and when considering Orton’s (1994, 14) point above, this must be taken into account, indeed the teaching of mathematics must have considerable overlap with a number of different subject areas if it is to be effective. This is a view put

forward by the renewed mathematics framework, which places emphasis on the importance of, *‘ making links between curriculum subjects and areas of learning,’* (DfES 2006, 13). Making meaningful links between other subject areas and mathematics could make what is learned more valuable as it becomes ‘ real’ for the learner.

Ernest puts forward the idea that, ‘ it is an unhappy learning experience for almost half of the population,’ (Ernest 2000, 8), referring to the experience of learning mathematics which five to sixteen year olds undergo. This would seem to be supported by current research, which indicates that students are reluctant to carry on their study of mathematics beyond GCSE level. Doctor Richard Pike of The Royal Society of Chemistry said in an interview with BBC News:

‘ *Schools and students are reluctant to consider A-level mathematics to age 18, because the subject is regarded as difficult, and with league tables and university entrance governed by A-level points, easier subjects are taken.’*

(Doctor Richard Pike, BBC news 2007)

This would seem to suggest that mathematics at A-level is considered too difficult and insufficiently interesting to tempt students to continue their studies after GCSE level. It also implies that schools and further education institutes are foregoing this more traditional subject in favour of more popular subjects. Doctor Pike also claims that because of this drop in the number of students taking A-Level mathematics, there has been a knock on effect for students wishing to study science at university:

‘ Increasingly, universities are having to mount remedial sessions for incoming science undergraduates because their maths skills are so limited, with many having stopped formal lessons in mathematics two years earlier at GCSE level.’ (Doctor Richard Pike, BBC news 2007)

If the fact that students are no longer choosing to take their mathematical studies forward into A-level can have such a knock-on effect on their university studies, surely it could be argued that giving students the opportunity to ‘ drop’ maths earlier in their education could have even greater implications. Pupils need to be fully aware of all implications before making choices about their A-Level studies. It would seem that thought should also be given to making the prospect of studying A-Level mathematics more attractive to both students, and educational establishments.

The concept of making mathematics more ‘ attractive’ to the potential A-Level student, takes us back to the discussion we started about the curriculum. It also links into Ernest’s thoughts on appreciating mathematics for its own sake. He discussed appreciating the social role mathematics plays, and has played in the past, (Ernest 2000, 7). Perhaps by incorporating the history of mathematics into pupils’ education it may give them an increased appreciation of the subject itself:

‘ *The appreciation of mathematics as making a unique contribution to human culture with special concepts and a powerful aesthetic of its own, is an aim for school mathematics often neglected by mathematicians and users of mathematics alike.’* (Ernest 2000, 7)

This would suggest that this aspect of mathematical education would be a valuable addition to the mathematics curriculum. Ernest also says that it would be a mistake to confuse an appreciation of maths with ability, as the two don’t necessarily go hand in hand. It is quite possible to develop an appreciation of maths without having an innate ability in the subject (Ernest 2000, 7). Indeed developing an appreciation for mathematics itself, may lead to an increased interest in the subject, consequently this may lead to an improvement in mathematical ability, as interest can be a key factor in children making academic progress.

In conclusion Ernest (2000) makes a number of interesting points in attempting to answer the question, ‘ Why Teach Mathematics?’ Despite the improvements made to the mathematics curriculum, and the teaching of mathematics, in recent years, there does not seem to have been a sufficient improvement in the number of pupils achieving A*-C grades at GCSE level. There has also been a knock-on effect on the number of pupils taking mathematics at A-Level and beyond, perhaps due to lack of interest, or perhaps due to the difficulty of the subject. Institutes of further education also seem reluctant for their pupils to study mathematics at A-Level. Ernest also puts forward the suggestion that pupils should be permitted to choose to what point they continue their mathematics education, however, this could also have multiple implications. It has been argued that a sound mathematical knowledge is essential for living and working in the world today, despite the fact that many occupations do not necessarily require the individual to have any formal mathematical qualifications. Ultimately a mathematical education would seem to be a necessity for pupils in full time

education, however, the way in which it is taught should be constantly reviewed in order for pupils to gain the full benefit of what they have learned. It is the responsibility of educators nationwide to ensure that pupils have a rich and varied mathematical experience, and that they themselves see the importance of teaching mathematics.

Bibliography

BBC News (2007)www. news. bbc. co. uk/2/hi/uk_news/education/6588695. stm, date accessed 27. 08. 07

DfES (2006) *Primary Framework for literacy and mathematics.* London: Department for Education and Skills.

DfES (1998) *The National Numeracy Strategy.* London: Department for Education and Skills.

Ernest, Paul (2000) *Why Teach Mathematics?* in Bramall, S and White, J (Eds) *Why Learn Maths?* Bedford Way Papers London: *Institute of Education*

Orton, Anthony (1994) *Aims of Teaching Mathematics* in Orton, Anthony and Wain, Geoffrey (eds) *Issues in Teaching Mathematics.* London: Cassell.

Wain, Geoffrey (1994) *Learning Styles and Teaching Mathematics: Towards Open Learning* in Orton, Anthony and Wain, Geoffrey (eds) *Issues in Teaching Mathematics.* London: Cassell.

Woodhead, Chris. (2007) *The GCSE's Failure* www. timesonline. co. uk/tol/news/uk/education/article2326707. ece, date accessed 27. 08. 07