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# Reflexivity, Effectiveness, and the Interaction of Researcher and Practitioner Worlds: a reflection on Bishop's "Research, Effectiveness, and the Practitioners' World" in the light of a quarter-century of systemic improvement effort in English mathematics education

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## Abstract

This contribution reflects on ideas about the interaction of researcher and practitioner worlds from Bishop's paper, drawing on the examples of the two major systemwide attempts to improve the quality and effectiveness of professional practice in English school mathematics since 1980. It examines how the reports which underpinned these attempts drew on relevant educational research and wider thinking about 'good practice'; it then traces the rise and fall of the ensuing reforms, identifying strengths and weaknesses of the approaches adopted. The first exemplar derives from the 1982 Cockcroft Report which gave rise to development initiatives influenced by ideas of action research and 'reflective' practice; this was eventually rebuffed as government grew sceptical of a devolved model of distributed professional leadership for educationally progressive reform, and moved to establish a highly centralised model based on unprecedented standardisation and regulation. The second exemplar derives from the 1998 Numeracy Task Force Report which represented a culmination of the trend to mandate systemwide use of 'effective' methods of mathematics teaching; this was eventually recognised as overly reductive given the prevalence of mechanical implementation by teachers and schools. From examination of these examples a number of key lessons are drawn:

- that official bodies exert as important an influence on the researchers' world as they do on the practitioners', shaping the kinds of educational research and developmental activity which can be undertaken;
- that mathematics education alone often provides insufficient resources to formulate adequate responses to issues of policy and practice; and thus that it needs to develop stronger interactions with complementary professional fields;
- that successful research-informed practice is likely to depend on dialogic creation of scholarly and craft knowledge through collaborative research; and on productive interplay between 'reflective' and 'effective' approaches to professional development.

## Introduction

Bishop's paper on 'Research, Effectiveness, and the Practitioners' World' was published in 1998. It originated as a summary reaction to the ICMI study conference on 'What is research in mathematics education, and what are its results?', held in 1994. As Bishop concedes, what he perceived as "researchers' difficulties of relating ideas from research with the practice of teaching and learning mathematics" (p. 33) may have been encouraged by the rather introverted character of this particular occasion. It is not surprising, after all, that a three-day meeting with a declared intention "to bring together representatives of… different groups of researchers, allow them to confront one another's views and approaches, and seek a better mutual understanding of what we might be talking about when we speak of research in mathematics education" (Sierpinska & Kilpatrick, 1998, p. 3) encouraged inward attention to intellectual differences rather than an outward focus on practical implications. Nevertheless, Bishop suggests that even when researchers do address issues of practice, the danger is that they do little more than provide evidence of problems and raise expectations about improvement, creating pressure for change rather than providing guidance for it. The central thrust of the paper is that researchers in mathematics education need to take (more) account of "the practical concerns of teachers" and to respond (better) to "pressures for more *effective* modes of mathematics education" (p. 34).

While the paper does allude to a political dimension to mathematics education, it largely passes over the powerful part that official agencies and policy-making bodies play in shaping educational reform, in supporting educational research, and in mediating between the two. Notably, government sponsorship of educational research usually reflects a desire for outcomes which can illuminate and advance the development of its policies and the changes in practice that these imply. Equally, while the paper acknowledges that "[m]uch clearly depends on the other practitioners who shape mathematics education" (p. 37), such as curriculum designers, textbook writers, external examiners, and school administrators, it gives little consideration to the role of intermediary bodies and organisations through which official policy is implemented and established practice adapted accordingly, and the part played in these processes by educational research. Moreover, where mathematics education is concerned, there is a considerable overlap in most educational systems between those who carry out teacher education and professional development on the one hand and educational research on the other; in particular, research in mathematics education would not survive in most universities without the financial base provided by these other activities. This paper will argue that, under such circumstances, official agencies and policy-making bodies exert as important an influence on the researchers' world as they do on the practitioners', shaping the kinds of educational research, developmental activity, and other forms of researcher engagement with practice which can be undertaken.

Indeed, the relative silence of Bishop's paper in this respect is surprising given Alan's personal contribution to leading one of the commissioned research reviews (Bishop & Nickson, 1983) that informed the work of the Cockcroft Committee in the early 1980s. So my argument will take Cockcroft as the starting point for a quarter century of endeavour to improve the quality and effectiveness of professional practice in English school mathematics in the light of relevant educational research (see also

Ruthven, 1999), influenced by wider thinking about strategies for the development of 'good practice' in teaching and learning (see also Ruthven, 2005). I will use the main lines of development over this period as a concrete counterpoint to assist reflection on some of the central ideas of Bishop's paper.

## The rise and rebuff of 'reflective practice'

*The rise*

The Cockcroft Committee was a very significant attempt to use insights from educational research to analyse and address concerns about the quality and effectiveness of professional practice in English school mathematics. Alan's substantial review (working with Marilyn Nickson) was one of three on different aspects of teaching and learning mathematics commissioned by the Department for Education on behalf of the Committee. In addition, the Department funded studies of the mathematical needs of employment and of everyday life, and a survey of relatively new entrants to mathematics teaching, to fill gaps in the available research identified by the Committee. The resulting Report (Cockcroft, 1982) sought to build professional consensus around a cogent system of ideas aimed directly at improving practice, explicitly informed by these thorough reviews of earlier developments and existing research. Equally, implementation of the Report's recommendations was marked by an unprecedented strengthening of intermediary capacity in two forms. First, there was support for substantial development projects, typically on an action-research model with strong teacher participation. Second, a national infrastructure was established to disseminate the Cockcroft ideas for reform through a network of advisory teachers, colloquially know as "mathematics missionaries". This precedent was surely in Alan's mind when he proposed not only that "researchers should pay more attention to synthesizing results and theories from different studies" (p. 42), but that "it is the practitioners' epistemologies which should provide the construct base of the synthesized theory" (p. 42).

The Report identified a basis for 'good practice': notably that mathematics teaching at all levels should include opportunities for exposition, discussion, practical work, problem solving, investigation, consolidation and practice (Cockcroft, 1982, para. 243). But, as the "missionary" metaphor signals, there was a tension within post-Cockcroft initiatives between actively promoting the innovative elements of this formulation and honouring the Report's reluctance "to indicate a definitive style for the teaching of mathematics" on the grounds that this was "[n]either desirable [n]or possible" (para. 242). Rather, the Report suggested that: "Approaches to the teaching of a particular piece of mathematics need to be related to the topic itself and to the abilities and experience of both teachers and pupils" (para. 242). Thus, some of the main post-Cockcroft initiatives involved networks of school-based teacher researchers working together under the leadership of university-based mathematics educators, influenced by ideas of action research and reflective practice. The action research approaches adopted in these initiatives corresponded closely with Bishop's view that "practitioners' problems and questions… should shape the research, not theory" (p. 40), so that "the research process should be a significant learning experience for the participants" (pp. 40-41), and "theory enter[] through the participants' knowledge schemes" (p. 41).

A significant example was the 'Raising Achievement in Mathematics Project' [RAMP] led by Afzal Ahmed, developed first in one region (LAMP, 1987), and then extended nationally (RAMP, 1991). While the project aimed to develop and encourage 'good practice' along the lines recommended by the Cockcroft Report, it was based on the principle that "improvements and change can only be sustained if teachers in the classroom believe in and support the developments taking place" so that "dissemination must always be firmly rooted in the personal experiences of teachers in their classrooms" (LAMP, 1987, pp. 81-82). Within the project, then, "teacher-researchers explored possibilities and ideas within their own classrooms, involved their colleagues through discussion and collaborative teaching and kept personal records". In particular, through "individuals writing and talking about their own situations and experiences in a personal and uninhibited way", the project produced "case studies" which although "by their nature… not prescriptive" could suggest "ingredients which other teachers may identify as being transferable to their own classroom". The goal was that "through such discussion and personal experimentation the processes of questioning, experimenting, reflecting and evaluating become embedded in a teacher's practice", to form a "cycle [which] is far from being a 'clinical' or 'academic' one" because of the way in which it calls for "teachers to reflect so intensely on their own classroom practice, beliefs and assumptions" (LAMP, 1987, p. 7). In line with this appeal to personal experience and social influence, the RAMP project sought to spread its "varied and continuously growing accumulation of knowledge and experience" by encouraging participants to initiate similar developmental work with other teachers and pupils, so as to "form a network which grows as teachers make new contacts and form new working groups" (LAMP, 1987, p. 7). Indeed, the Foreword to the report of the first phase of the project illustrates its epistemic commitment to a social process of knowledge diffusion in which local validation through personal activity and judgement are viewed as crucial:

> The nature of the report reflects the quality of all this ongoing personal classroom-based research. The recommendations for action and the statements made are careful distillations of these experiences. The report is hence an invitation to those concerned with education at *all* levels to experiment, discuss, debate, strengthen and refute as a result of their *own* experiences. It is about taking action. (LAMP, 1987, p. vii)

This emphasis on teacher involvement in sustained developmental activities was characteristic of post-Cockcroft initiatives intended to realise reforms in curriculum, pedagogy and assessment along the lines proposed by the Report. Nevertheless, as wider stocktaking of practitioner action research has concluded (Elliott & Sarland, 1995; Elliott, Maclure & Sarland, 1997), that while it can serve as an effective means of engaging teachers in professional development, the challenge of bringing participants to rigorously examine – in Bishop's terms – "their own work, with the explicit aim of improvement, and following an essentially critical approach to schooling" (p. 39) is a considerable one. While "teachers often see the proposals for change made by others as 'frivolous' when they do not actually affect their working constraints" (p. 36), the changes that schools and teachers are able to envisage and effect often reflect assumed constraints on, and associated patterns of, practice which have become professionally reified. Thus while Bishop suggests that "it is only practitioners who have it in their power to change… practice" (p. 35), he also highlights "the classroom and institutional realities which shape th[is] practice" (p.

41). Indeed, the shift in such 'realities' within the English system over the decade between publication of the Cockcroft Report in 1982 and Alan's departure for Australia in 1992 serves to emphasise not only their influence but their mutability.

*The rebuff*

By the close of this period, the type of developmental activity receiving official support had changed markedly, as government grew sceptical of the devolved model of distributed professional leadership for educationally progressive reform associated with the post-Cockcroft initiatives in mathematics (and with wider educational innovation across the school system as a whole). Equally, the strongly developmental emphasis of these initiatives meant that there was little hard evidence and few cumulative insights with which to counter such scepticism:

> It is clear that these projects did impact on teachers and curricula, but, unfortunately, even where careful evaluations were carried out these were not reported in 'refereed journals', subject to peer review. In this sense, then, accumulated knowledge and experience is not available to be passed on and every new project 'reinvents the wheel'. Properly planned and funded evaluations should be a feature… in the future so that succeeding curriculum developments can build on the strengths and address the weaknesses of previous innovations. (Askew & Wiliam, 1995, p. 43)

The 1987 Education Reform Act [ERA] laid the ground for a radical change in English schooling towards a centralised model based on unprecedented standardisation and regulation. Although the initial plans devised by the National Curriculum Mathematics Working Group envisaged a continuation of post-Cockcroft notions of 'good practice', these plans were undermined as the government embraced an increasingly 'back to basics' stance on educational matters, which included reverting to more reductive models of school mathematics (Dowling & Noss, 1990; Brown, 1993). Symptomatically, whereas the report on the first phase of RAMP (LAMP, 1987) was accorded some official standing through publication as a government document, the report on the second phase was not treated in the same way (RAMP, 1991). By that time, schools and teachers were being pressed to 'deliver' a national curriculum and become 'compliant' with national regulations, reinforced by high-stakes systems of school and teacher evaluation through regular pupil testing and school inspection.

The pattern of continuing professional development for teachers shifted markedly. The majority of provision was now managed directly by government agencies, and this focused on familiarising teachers with the new curriculum and assessment regime. The primary mechanism for professional development now became the distribution of official documents and guidance materials, supported by a 'cascade' approach in which schools nominated subject leaders to attend organised training sessions with a view to their then leading similar activity with their school colleagues, sometimes with help from local authority advisory teachers. The role of universities in professional development was much reduced; the reflexivity which was the hallmark of their approach did not fit this emerging technocratic model for systemic improvement in education. Indeed, as its educational policy grew more directive, the government became, to echo Bishop's words, "politically antagonistic to institutionalized critique, and increasingly impatient with 'time wasting' reflection

and questioning" (p. 43). Government politicians adopted a 'discourse of derision', lambasting university-based teacher education and educational research, with one minister memorably characterising the results of some of the very work that his predecessors had commissioned as 'barmy theory' and 'elaborate nonsense'.

In initial teacher education, then, new school-based routes were established and encouraged by government. However, severe teacher shortages and limited school capacity meant that the university contribution in this area could not be wholly discounted. Rather, government strengthened recent reforms which had introduced official regulation and evaluation of initial teacher education. In addition to lecturers being required to undertake 'recent and relevant experience' as school teachers, student teachers following what was now restyled as 'teacher training' were obliged to spend the great majority of their programme on school placement. Even more significantly, the collegial style which had persuaded universities to accept the introduction of official inspection of their courses of teacher education was set aside by government in favour of a much more authoritarian approach, and these programmes now became subject to detailed prescription and tight regulation in much the same way as schools. Alan encountered these reforms directly as a teacher educator on the postgraduate course in Cambridge that we taught together. Although widely perceived as acts of political spite, they did provide useful scope for small-scale, classroom-based research by lecturers (Bishop, 1991; Ruthven, 1989) and new opportunities to enhance the quality of teacher preparation on a 'practical theorising' model (McIntyre, 1995; Ruthven, 2001).

The overall effect of these shifts in policy was to produce a marked realignment of the relationship between government, universities and schools, marginalising the more analytic and reflexive contribution of university-led educational research, teacher education and professional development to political and professional thinking. Whereas many university-based mathematics educators – most of whom brought to this work a successful professional history as schoolteachers and a strong commitment to educational improvement – had been deeply involved in the developmental activity and design research surrounding the Cockcroft review and the subsequent implementation of its recommendations, these new conditions of tight government regulation and evaluation made it difficult to carry out independent work of this type. Not surprisingly, many university-based mathematics educators adapted to this changed situation by pursuing lines of research and scholarship that allowed them to express professional detachment from the reforms. Perhaps much of the passion with which Alan wrote his paper arose from his experience as President of the Mathematical Association during this politically charged period, concerned with the capacity of the profession to engage with these reforms, and their impact on it.

## The rise and redux of 'effective practice'

*The rise*

Thus, by the time that Alan left England in 1992, "increasing pressures for more *effective* modes of… education" (p. 34) had come to dominate schooling policy, with external testing of pupils in the process of being introduced at four points between ages 7 and 16. Under a policy of 'open enrolment', schools competed to attract pupils (with a school's funding related to its success in recruitment) in a 'market' designed to be strongly influenced by the annual publication of 'league tables' intended to inform prospective pupils and their parents about the relative success of schools on key 'performance indicators' (notably the test and examination performance of their students). Increasingly, too, schools were competing to attract and retain teachers against a background of intensifying shortages in subjects such as mathematics. In trying to raise their measured 'effectiveness', common strategies adopted by schools were to teach to the test; to give pupils more regular practice of test-taking; to give special attention to those pupils working close to the 'pass/fail' boundaries for testing; and to prioritise classes containing such pupils when assigning teachers.

In 1997, a change of government brought a further intensification of these pressures through the setting of ambitious targets, increasing annually, for the proportions of students achieving benchmark levels of performance in each school. However, the new government was also determined to exercise a more direct influence on matters of classroom pedagogy and school management, encouraged by the confidence with which some educational figures argued that it was possible to identify effective teaching methods and implant them in schools. One of these – a leading researcher in school effectiveness and improvement – was appointed by the new government to chair its 'Numeracy Task Force'. Also amongst the members of the Task Force was a highly experienced professional leader in mathematics education, who was now directing what was already termed the 'National Numeracy Project', established within the Department for Education by the outgoing government to develop, trial and refine 'interactive whole-class' teaching methods at primary-school level. The work of the Task Force was closely 'observed' by eight representatives from government agencies with a strong interest in its proposals, including four from the newly created 'Standards and Effectiveness Unit' within the Department for Education which would take responsibility for implementing the resulting National Numeracy Strategy, initially in primary schools, but rapidly extended to lower secondary.

The business of the Task Force was highly politicised. Not only was it charged with quickly producing a viable strategy capable of rapid implementation, but it was constrained in the options it could seriously consider by the ideological unacceptability of many of them to government ministers and their officials, regardless of what research might indicate (Brown et al., 1998, p. 378; Brown et al., 2003, p. 670). Under these conditions, there was little alternative but to largely endorse a scaling up of the approach of the existing National Numeracy Project to provide the basis for the National Numeracy Strategy (Brown et al., 2000, pp. 460-461). Hence, the Task Force Reports (DfEE, 1998a, 1998b) were written in a style in which professional judgements from privileged sources were corroborated by general appeals to 'the research literature', as illustrated by this opening paragraph from the brief section entitled 'Whole class teaching':

> Inspection evidence and the experience of the National Numeracy Project point to an association between more successful teaching of numeracy and a higher proportion of whole class teaching. There is support for this in the research literature, which also identifies the quality of the teaching as the key factor. (DfEE, 1998a, p. 19)

The reports themselves contained few explicit references to research. Although a more substantial bibliography of what was represented as relevant research was eventually published (Reynolds & Muijs, 1999), no public account was offered of how consideration of this material had influenced the recommendations made by the Task Force. However, addressing the question, 'Is the National Numeracy Strategy Research-Based?', Brown and colleagues were able to draw on direct experience of the deliberations of the Task Force in concluding that:

> [S]ometimes recommendations are quite strongly underpinned, sometimes the evidence is ambiguous, sometimes there is little relevant literature, and sometimes the research is at odds with the recommendations… The research findings are sometimes equivocal and allow differences of interpretation.… The complexity of the findings and of the possible interpretations suggests that ministerial desires for simply telling 'what works' are unrealistic. (Brown et al., 1998, p. 378)

Nevertheless, they (Brown et al., 2003, pp. 656-657) also note that once responsibility for implementation of the National Numeracy Strategy moved on from the Task Force, account was taken of ways in which insights from relevant research in mathematics education could guide the more detailed formulations required, particularly as regards the elaboration of learning objectives, curricular sequences and teaching approaches.

The key features of the classroom approach advocated in the Task Force Reports were an emphasis on calculation, especially mental calculation; adoption of a standard three-part template for daily mathematics lessons, incorporating direct interactive teaching of whole classes and groups; and meticulous planning of teaching based on a detailed framework of learning objectives linked to a weekly schedule. However, in keeping with the strong influence on the Task Force of ideas from the field of school effectiveness and improvement, other recommendations addressed those aspects of the reform with equal vigour. In particular, the Strategy showed no embarrassment about – in Bishop's terms – "perpetuat[ing a] centre-periphery model of educational change" (p. 39) and "assum[ing a] power structure which accords the researcher's agenda and actions greater authority than the practitioner's" (p. 36). However, the underlying model of change was more sophisticated in at least two important respects than the representation by Popkewitz as outlined by Bishop (p. 39). First, the various bodies of research and experience that the Strategy drew on included many directly concerned with practice. Second, the approach to leveraging change recognised the need to complement the 'high pressure' of accountability already established within the system with correspondingly 'high support' for schools and teachers in the form of much stronger incentives and mechanisms for building professional capacity for educational improvement (Earl et al., 2003: p. 130). Indeed, through this "high pressure and high support" approach the Strategy might be seen as taking account of Desforges and Cockburn's injunction – as quoted by Bishop – to accept responsibility for "provid[ing] the crucial psychological parameters of the teaching environment to which teachers and children alike must adapt" (p. 42).

While bent on changing teaching practice, however, the Task Force was alert to the need to take account of "teachers' behaviours in the context of… teachers' reality" (p. 41). One consideration which weighed strongly with members of the Task Force in favour of adopting the National Numeracy Project as the basis for a national strategy was the positive evaluation it had received from teachers already involved in the project. These teachers identified certain features of the project's provision as particularly helpful: the detailed framework of learning objectives, the booklet of exemplar lessons, the training provided on mental calculation strategies, and in-school support from advisory teachers (Brown et al., 2000, p. 461). Contrary to the misgivings expressed by many academics, teachers across the country were similarly positive about the National Numeracy Strategy as its implementation developed (Brown et al., 2000; Earl et al., 2003). The external evaluation indicated that the Strategy's approach of seeking to provide 'high support' to help teachers respond to the 'high pressure' placed on them had resonated with practitioners. The evaluation reported that "schools were inclined to acquiesce to, and approve of" what had been termed the 'informed prescription' of the Strategy, noting that "[h]eadteachers and teachers often expressed relief that they had been given the frameworks and curriculum materials to better cope with the pressure from national tests, Ofsted inspections, imposed targets and high workloads" (Earl et al., 2003, p. 130). For example, 74% of teachers agreed with statements to the effect that their teaching was more effective as a result of the Strategy, against 7% disagreeing; and 59% that the Strategy had helped make their job more satisfying and engaging, against 12% disagreeing (Earl et al., 2003, pp. 85-86). Such approval was not confined to primary teachers; an external evaluation of the Strategy's extension to secondary schools reported similarly that mathematics teachers at that level generally found the framework of learning objectives very helpful, had positive reactions to the training provided, and valued the support from advisory teachers (Stoll et al., 2003, pp. 36-41).

*The redux*

The external evaluation of the National Literacy and Numeracy Strategies reported that teachers were positive about the influence of the latter on aspects of pupil learning (Earl et al., 2003, p. 82). In the crucial terms of pupil performance on national tests at the end of primary school, the early years of the National Numeracy Strategy certainly saw a rise in the proportion of pupils achieving the benchmark level (Earl et al., 2003, p. 128). However, while gains were made until 2000, rates stalled in subsequent years, suggesting that a plateau had already been reached. Moreover, a study based on analysis of repeated administrations of an independent test-series to large national samples of pupils, conducted over the period from 1998 to 2002, showed a very modest rise in performance (Brown et al., 2003). Both major studies of the implementation of the Strategy suggested that early improvement of performance on the national tests resulted, to an important degree, from sharper focusing of classroom activity on their particular demands (Brown et al., 2003, p. 669; Earl et al., 2003, p. 137). Nevertheless, more specific ways were identified in which the treatment of particular aspects of mathematics had undergone widespread and beneficial change. The external evaluation reported that the majority of headteachers agreed that teachers in their school had significantly changed their teaching practices in mental mathematics as a result of the Strategy (Earl et al., 2001, p. 50). Correspondingly, the majority of teachers agreed that pupils were performing at a

higher level in oral/mental mathematics as a result of the Strategy (Earl et al., 2003, p. 82). Moreover, in the other major study, fuller analysis at the item level of the evidence from independent testing indicated that "in general, those areas in which there is an improvement are those where it is clear that guidance given [by the Strategy] ha[s] updated the ways that topics have been taught in line with research findings, and increased the time allocated to them" (Brown et al., 2003, p. 667).

The key changes in classroom organisation and resources resulting from implementation of the Strategy are summarised in the external evaluation as follows:

> Up to the early or mid 1990s, schools were characterised by a predominance of individualised planning and teaching, with pace largely determined by pupil readiness as perceived by teachers. In mathematics, many teachers used commercial schemes of work, which children worked through at their own rate, often with little direct teacher intervention. The big shifts as a result of the Strateg[y] have been greater use of whole class teaching, greater attention to the pace of lessons, and planning based on objectives rather than activities. Most teachers are using the format and structure of… the three-part daily mathematics lesson, although most have modified these as they gained confidence. (Earl et al., 2003, p. 127)

Overall, however, the external evaluation concluded that:

> Although the most obvious features of the reforms appear in virtually all classrooms, our data show considerable disparity across teachers and schools in understanding of the Strateg[y] and in subject and pedagogical knowledge and skill. In many cases the Strateg[y] ha[s] not yet produced the needed depth of change in teaching and learning. (Earl et al., 2003, p. 140)

The other major study focused more directly on change in teaching practice and beliefs and drew the similar conclusion that "teaching in the classroom seems to have changed mainly in superficial ways, e.g. organisation of lessons and resources used", whereas "[w]hen the beliefs of the teachers about how children should learn and be taught numeracy…, and the way that teachers interact with children, are examined, it appears that in almost no cases have 'deep' changes taken place" (Brown et al., 2003, p. 668).

The reported prevalence of overly mechanical implementation of the Strategy suggests that it has been more successful in implanting a concrete apparatus of pedagogical practice in schools than in helping teachers to form this apparatus into a cogent system of tools which they are able to employ in flexible and discriminating ways. In secondary mathematics, for example, school inspections (OfStEd, 2004) indicate that while "the influence of the Strategy on curriculum planning has been beneficial where departments have revised their existing schemes of work to take account of the *Framework* and make best use of the available resources" (para. 79), this contrasts with the situation in around half the departments visited which have "adopted the sample medium-term plans issued by the Strategy too uncritically" (para. 80). Likewise, while "in the better practice, teachers use the recommended lesson structure in a flexible way, seeing it as a useful approach rather than a binding requirement" (para. 82), "in unsatisfactory lessons, teachers use a three-part lesson structure without thinking through the purpose of its various parts" (para. 84). Similarly, use by schools of internal assessment to focus on developing and securing pupil understanding of particular 'key objectives' is contrasted favourably with use of short tests to award finely graded 'attainment levels' (para. 88).

During the early years of the Strategy, schools and teachers were steered towards mechanical implementation through the strong direction from the centre and heavy pressure for compliance which led to it being perceived as "a one-size-fits-all approach to teaching imposed on a widely diverse range of schools" (Earl et al., 2003. pp. 7, 135). While the small print of Strategy documents may have acknowledged possibilities of variation and adaptation, the bold titles of Strategy presentations conveyed a more prescriptive message, as did school inspections explicitly focused on recommended features from the Strategy (Stoll et al., 2003, pp. 31, 34). This inflexible approach represented an unpromising start for a policy which purported to build professional capacity for thoughtful adoption and localised adaptation; rather it was intended to meet the political imperative for rapid improvement in headline test performance. The external evaluation of the Strategy suggests that a shift towards a more devolved approach has become desirable as relatively straightforward initial gains have been exhausted. However, moving from a culture emphasising conformity to one encouraging local initiative through introducing greater flexibility over implementation creates a challenge of how "to push towards conditions where… schools and teachers have the capacity to adapt, solve problems and refine their practice, while remaining true to the principles underlying the Strategies" (Earl et al., 2003, p. 135). The reported differences in the degree to which schools and teachers have gone beyond superficial implementation of the Strategy to informed interpretation and adaptation appear to have been strongly influenced by existing variation in school and teacher capacity and confidence. The evaluation of the Strategy reports that many schools found it difficult to put such factors in place, let alone approach the ideal of the school as a learning organisation; it points to a considerable need for more sustained professional development aimed at promoting confident handling of subject matter and informed reflection on pedagogical issues. In effect, it constitutes recognition of the need for the new institutional structuring of educational improvement to be complemented by deeper processes of research-informed professional development of the type endorsed by Bishop.

**Lessons to be learned**

This history of a quarter-century of systemic improvement effort in English mathematics education is, of course, a caricatural one. However, use of caricature as a didactic device aims to focus attention on key lessons.

The first of these key lessons was announced in my opening comments: that official agencies and policy-making bodies exert as important an influence on the researchers' world as they do on the practitioners', shaping the kinds of educational research, developmental activity, and other forms of researcher engagement with practice which can be undertaken. This has been an explicit thread of the argument, highlighted by the way in which national policy shifts during the late 1980s radically changed the terms on which university-based mathematics educators participated in initial teacher education and continuing professional development, marginalising the reflective dimension of these programmes, and limiting scope for the kinds of developmental research in which many university mathematics educators had been involved during the post-Cockcroft era. However, the new emphasis on educational evaluation and systemic change created opportunities for other fields of educational research, notably that of school effectiveness and improvement which was better able

to engage with the new political agenda on its own terms. We can see this shift clearly if we compare the briefs of the Cockcroft Committee and the Numeracy Task Force. Whereas the Cockcroft Committee was asked "to consider the teaching of mathematics… with particular regard to its effectiveness and intelligibility and to the match between the mathematical curriculum and the skills required in further education, employment and adult life generally" (Cockcroft, 1982, p. ix), the remit of the Numeracy Task Force "to develop a national strategy to raise standards of numeracy in order to reach the national numeracy target by 2002" (DfEE, 1988a, p. 4) was much more technocratically framed and narrowly focused. Equally, whereas the Cockcroft Committee adopted a problematic largely drawn from the field of mathematics education, the Numeracy Task Force was more strongly influenced by conceptualisations developed within the fields of teacher effectiveness and school improvement. Finally, in contrast to the lengthy period granted the Cockcroft Committee for its deliberations (stretching from 1978 to 1982), which enabled it to carry out extensive groundwork and build professional and political consensus, the Numeracy Task Force was pressed to produce recommendations in line with the new government's policy aspirations within six months, and – following an interval for consultation – an implementation strategy within an even shorter period.

To the degree that, as Bishop suggests, "[m]ost [researchers] would probably still yearn longingly for the academic ideal of the disinterested researcher" (p. 42), it would be easy to denigrate the shift in political culture between the Cockcroft Report and the Numeracy Task Force. However, fuller reflection shows it raises questions which the mathematics education community (and not just the researchers within it) needs to consider. First, mathematics education is by definition selective in its attention. It develops powerful understandings of the specifically mathematical aspects of educational practice, but it either neglects many other aspects of this practice (such as many on which the school effectiveness and improvement field focuses), or conceptualises them in ways which prioritise the mathematically significant dimensions over others. The result is that mathematics education alone is often unable to adequately address holistic problems of policy and practice of the types which the Cockcroft Committee and the Numeracy Task Force were established to tackle. Equally, the understandable valorisation of mathematical aspects over others has had the unfortunate corollary of encouraging an insularity which poorly equips the field to enter the kinds of collaboration necessary to address many issues of educational policy and practice through bringing the specialised perspectives of several fields to bear on them. Successful collaboration of this type has to be more than simply an *ad hoc* matter. While lengthy deliberations and full consultations with different constituencies enabled the Cockcroft Committee to establish wide professional and political support, the intellectual basis on which that support was gained was not consolidated sufficiently and developed adequately to meet the challenges which emerged over subsequent years. For example, wider support for a conception of mathematical capability which extended beyond 'basic skills' and 'simple tests' to encompass relational understanding, realistic application, and technology integration proved relatively short-lived. In particular, under the pressured conditions in which the Numeracy Task Force operated, the absence of established common ground between the school effectiveness and mathematics education specialists had far reaching consequences. For example, not only did it act as a significant impediment to securing support for that broader conception of mathematical capability, it led to much greater weight being attached to the

pedagogical models endorsed by earlier teacher effectiveness research which took narrower definitions of mathematical capability for granted. This reveals a second key lesson: that mathematics education alone often provides insufficient resources to formulate adequate responses to issues of policy and practice; and thus that mathematics education needs to develop stronger interactions with complementary professional fields. Perhaps this is a development for which a future ICMI conference on 'Cooperation between Research Fields in the Systemic Improvement of Mathematics Education' could provide international leadership?

These key lessons accord, then, with the spirit of Bishop's closing recommendations that "[i]nstitutional context and constraints should be given greater prominence in research" and that "[t]he process of change needs to be a greater focus in research on mathematics teaching" (p. 43), but to suggest that the most effective strategy might be for mathematics education to build stronger collaboration and dialogue with those fields of educational enquiry and practice which focus specifically on such issues. This leads to a third key lesson: that it is important that mathematics education retain its clear focus but develop its capacity for synergy with wider perspectives. This includes a broadening of Bishop's recommendation that "[t]eam research by researchers/practitioners should be emphasised" (p. 43) to encompass greater multidisciplinarity of researchers within such teams. Huberman has pointed to some of the benefits of 'sustained interaction' between researchers and teachers, "in which researchers defend their findings and some practitioners dismiss them, transform them, or use them selectively and strategically in their own settings" (Huberman, 1993, p. 34). Reframing ideas in order to address the qualifications and challenges identified through collaboration with teachers appears to trigger a decentring process amongst researchers. In particular, it creates a need to marshal a broader range of scholarly thinking and research experience; and teams containing mathematics educators alone are often ill equipped to do this. But multidisciplinary teams do not simply enrich the range of ideas and techniques available; by introducing further perspectives and fresh challenges, they help mathematics education researchers to refine their tools and strengthen their arguments. Strong collaboration with teachers is also important in research aiming to develop professional practice because of the person-embodied, tool-mediated and setting-embedded practitioner craft which is key to making such practice realisable. In this respect I would strengthen Bishop's recommendation that "Researchers need to focus more attention on practitioners' everyday situations and perspectives" (p. 43), to argue that developmental research needs to incorporate a dialogic cycle of knowledge-creation through which, on the one hand, theorised scholarly knowledge is contextualised and activated within teaching, stimulating construction of relevant practitioner craft knowledge; while, on the other hand, some that teacher craft knowledge is elicited and codified in a form which can help improve the effectiveness with which the training and coaching of other teachers can be undertaken, by providing more explicit frameworks for analysing teaching processes, for articulating mechanisms and functions, and for understanding adaptation to different conditions (Ruthven, 2002).

The last of Bishop's recommendations deals with the dissemination of research. In comparison with the efforts expended on this over both the post-Cockcroft and post-ERA periods, and the highly active approaches adopted, the recommendation that "[c]onclusions and outcomes should be published in forms which are accessible to the maximum number of practitioners" (p. 44) seems an unambitious recommendation

from a paper seeking to encourage researchers to enter and engage with the practitioners' world. However, it could be seen as an appropriately modest response to the thread of disappointment with the effectiveness of dissemination which runs through this history. Indeed, this disappointment might seem to oblige us to accept Desforges and Cockburn's pessimistic conclusion – as quoted and endorsed by Bishop – that "classrooms as presently conceived and resourced are simply not good places in which to expect the development of the sorts of higher-order skills currently desired from a mathematics curriculum" (p. 41). But the proponents of 'reflective' and 'effective' practice' would both counter with powerful examples of schools and teachers where the approach in question has supported improvements in practice, while conceding that it has failed to be proved a general panacea. Rather, a more plausible reading of this history is that each approach has been more successful where important elements of the other were also present: practitioner-centred 'reflective practice' disciplined by careful attention to clear objectives and hard evidence; research-informed 'effective practice' mediated by educated use and thoughtful adaptation of the techniques and tools provided. Indeed, this was the opinion of two of the doyens of the effective teaching field from whose work – ironically – much of the National Numeracy Strategy's prescription for 'effective practice' was derived:

> It should also be stressed that there is no single system for presenting mathematics concepts effectively. For example, some of the control teachers in our studies have obtained high levels of student achievement using instructional systems that differed from those in the program we developed… Research… yields… concepts and criteria that can be applied in order to examine classroom instruction. Hence, in current work [we] are not advocating that teachers… implement behaviour in a mechanical fashion. Rather, [our] efforts are to use the findings to stimulate teachers to discuss… the various ways this model can be implemented in classrooms. (Good & Biddle, 1988, p. 131).

The last lesson, then, is that success in developing research-informed practice is likely to depend both on dialogic development of scholarly and craft knowledge at the stage of research, and on productive interplay between 'reflective' and 'effective' approaches at the stage of wider dissemination. Happily, this is a lesson which the English government appears now to be starting to learn. It has recently supported the establishment of a National Centre for Excellence in Teaching Mathematics on a model which recognises that building professional capacity in the field depends on processes of both these types.

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