“BACK to basics” or “FORWARD to basics”?

Thelma Perso
Queensland Department of Education
<thelma.perso@deta.qld.gov.au>

Politicians have used the promise of “back to basics in our schools” as an educational platform for some time now, possibly in recognition that this is something the general population perceives as an issue they might just vote for.

In the various positions I have held, both professional and in community service, I have been required to respond to ministerial correspondence, questions on notice in parliament, questions by the media and policy positions on issues such as the following:

- When are children taught long division?
- Why aren’t children taught long division anymore?
- Why can’t our children work with fractions?
- Why do children need a calculator to work things out when we were taught to do them in our heads?

For voters to ask these questions of their member of parliament and for them subsequently to make headlines in newspapers, these questions clearly strike a chord with many members of the voting public. In this paper I will discuss this phenomenon from my perspective as a public servant and from a broader perspective as a mathematics educator and teacher. It is not my intention to provide definitive answers, merely to raise awareness, explore this topic, and make suggestions for solutions in the hope that we, as teachers and educators, can gain a better understanding of the issues and why they are issues. Thus we might be able to provide informed responses to the community and parents when the issues are raised.

What does “back to basics” mean?

Calls for “back to basics” in our schools imply that these “basics” are being neglected by teachers or are not being taught well in our schools today. The use of the word “back” helps us get some insight into what the “basics” are that parents and politicians would want taught in our schools. The “looking back” to basics implies that what we need to be teaching and focusing on in schools are the basic arithmetic skills that were the backbone of many ’60s and ’70s classes experienced by parents and politicians. These basics

include computation skills such as addition, subtraction, multiplication and addition, and some foundational measurement skills.

The assumption that these "basics" are being neglected in our schools is not correct. Indeed, many children are currently being over-exposed to these identified basics and this in itself is problematic.

In the sixties and early seventies, computational technologies, such as calculators and computers, were rare and not generally available to the public. As a result, mathematics lessons tended to focus on the teaching and practice of the "basics" of that era since these were needed in employment and for life tasks such as budgeting, reckoning and accounting. The role of the teacher in teaching mathematics was to ensure that children and young people were taught to be reckoners: taught to perform these skills by rote methods and given multiple opportunities to practice them in order to become fluent and efficient in their use.

Cries for "back to basics" by parents are frequently indicative of a desire for mathematics lessons in schools to "look the same" as they did in the '60s and '70s. At the very least it is a plea for similar content to be taught and moreover, taught using the same methods of drill and practice that were used back then. Is this still the purpose for focusing on and practicing these skills? If not, why do parents believe it is? How often do parents use these skills themselves?

A focus on aspects of computation (at the expense of the rest of the mathematics curriculum currently demanded of schools) is flawed on at least three counts. Firstly, it implies that the availability of common computational technologies such as hand-held calculators has not (and should not) have an impact on school mathematics. Secondly, it denies that our knowledge of how children learn mathematics (gained through research over the past 30 years) ought to influence how mathematics should be taught. Finally, it ignores both the reality that western society in the 21st century is a knowledge society and the resultant changing characteristics of the student cohort.

So what has changed?

Parents demanding that their children understand what a calculator does before being given one to use are really expressing a fear that their children will rely on the computational tool and not learn the underlying computational skills. This is a reasonable argument, but depends entirely on how the classroom teacher uses the calculator in their teaching program. I recall a teacher saying to me once: "If I gave all my Year Fours a calculator what mathematics would I teach them?" This is a concern because the comment reveals that the classroom teacher believes it is still his/her role to teach children to be reckoners, as was the case in the '60s when calculators were not available. I was taught to be a calculator and so were the majority of baby-boomers. With calculators now readily available, it is nonsense to suggest that this is still the purpose of learning mathematics in school. Indeed, the availability of calculators has (or should have) dramatically changed the nature of school mathematics.

Questions such as, "Why aren't children being taught long division anymore?" lie at the heart of the matter. In fact, long division is seen as a type of benchmark: if you can "do" long division you must be good at maths. This popular belief (which may have been true in the '60s) could not be further from the truth today. In real life, today, the operation of division is

used as a small part of solving a situated problem that begins with the recognition that division is needed; in the '60s, when the context for learning mathematical skills was often in order "to pass the exam or test" an ability to perform the long division algorithm was an achievement in its own right.

"Long division" is merely a procedure for finding an answer to a problem that requires division. There are many methods of computing such an answer and the long division algorithm is but one (and usually the only one we learned at school). It is neither essential nor sufficient that students learn just one method for dividing. What is essential is that students can determine when division is needed from a situation, estimate the solution using mental computation based on their knowledge of numbers and how they work, perform the calculation (using a method of their choice, including a calculator) and judge the reasonableness of the solution obtained based on their estimation and the context or situation.

So, performing the operation of division is but a small part of the process. Consequently a focus on this part of the activity in classrooms is inappropriate. Although it is necessary for students to be able to do division, it is not sufficient for their learning of mathematics.

What about rigour?

The media (and even some Governments) would have the general public believe that basic computational skills are all that matters and the meta-cognition (making of decisions, judgements and analysis) that sits around performing these skills is "mumbo-jumbo"; that any attempt to pay attention to the critical thinking that sits behind the decision-making needed in the learning process amounts to a "dumbing-down" of the curriculum. Research indicates that real learning occurs when children apply procedures to real life situations and critique and reflect on how and why they work (Wells, 1999). I would also argue that the higher-order meta-cognition now demanded of students is far more rigorous than the performance of procedures which dominated mathematics curricula in the '60s and '70s, and unfortunately still abounds in many classrooms.

Note that I am not advocating that we should not teach the computational "basics" demanded by parents for their children in our schools anymore. It is not a question of either basics or higher-order thinking skills; it is a question of balance: both are necessary and neither is sufficient without the other. More will be said of this later.

Changing conditions

The mathematics taught in schools is determined broadly on the basis of the mathematics demands of life and of work. In the '60s and '70s these demands were primarily, as suggested previously, that students be able to perform computational skills and some measurement skills in order to reckon, budget, account and measure. More specialist mathematics skills were generally taught on the job. Other workplace skills such as being able to work in teams, communicate, pose questions, think laterally and so on, were also taught on the job.

Economic and technological changes over the past three or four decades have meant that the demands of work and life on individuals are now radi-

cally different from what they were in the '60s and '70s. Surely no-one would disagree with this. If it is a major function of schooling to prepare students for life and work and the nature of life and work has changed, then clearly what is taught in schools must change accordingly.

Curriculum for the 21st century

In the '60s, students were viewed as empty vessels needing to be filled up with knowledge. Furthermore, the amount of knowledge imparted to them was viewed as being almost sufficient to get them through their entire lives. With the knowledge explosion of recent decades, this is no longer possible. There is now general recognition that children and young people need to be taught how to learn so that they can continue learning throughout their lives. Schooling no longer prepares young people for a single career, since young people may have multiple careers in the 21st century. Further to this, young people need to use their knowledge differently, particularly in creative and flexible ways. Students need to go well beyond merely acquiring a body of facts and skills. They must fully understand the knowledge they have acquired, critically appraise it, apply it in a range of contexts, and work with it to construct new knowledge. (Wells, 1999, p.76) So, knowledge needs to be presented to, or accessed by, students through a variety of means, enabling them to construct the knowledge and make sense of it, and then transform it.

Bereiter and Scardamalia (1998) argue that, for students to be able to work with knowledge they need to be able to:

- represent and share their knowledge;
- identify that knowledge can occur in different contexts and can be viewed from different perspectives;
- view themselves as constructors of knowledge;
- understand their knowledge as being subject to revision and able to be improved; and
- be aware that knowledge objects can be manipulated and judged.

They go on to say that, since students need to view knowledge from different perspectives, construct knowledge, improve knowledge and critique knowledge, knowledge therefore requires not just cognitive processes but also social interaction and effective performance by individuals.

Tensions between mathematical content and necessary processes and skills

Schools and classrooms are no longer a venue for teachers just to transmit knowledge, in the form of facts and procedural skills, to their students. Nor can students learn how to apply knowledge or work with knowledge if they do not learn any knowledge in the first place.

Tensions arise between the amount of content/discipline knowledge considered essential and the processes and skills that need to be taught as part of learning the knowledge. The question of balance is critical. Supporters of TIMSS[1] for example would likely say that mathematics content knowledge is much more important than being able to apply and transform it, while supporters of PISA[2] would say the opposite is true. Employer groups might say that application and transformation of mathematics knowledge is critical, while higher education groups might say that

1. TIMSS (Trends in Mathematics and Science Study) — an international testing program; the mathematics component focuses on mathematics content

2. PISA (Program for International Student Assessment) — an OECD international testing program; the mathematics component focuses on mathematical literacy.

mathematics content is far more important.

Unfortunately, schools (and mathematics curricula) are caught in the middle of these tensions and find they are unable to please everyone. Moreover, the media tend not to give a balanced view but focus on one perspective only, using PISA or TIMSS results to support a case, when and as needed.

Mathematics curriculum for the 21st century

Most mathematics curricula around Australia have stayed abreast of the changes outlined above and are now supporting teachers of mathematics to use Working Mathematically processes in their teaching and learning programs. Teachers are being urged to balance the meta-cognitive processes and skills with mathematics content and it is the teaching of Working Mathematically processes that enables this. This does not mean that teachers are no longer required to focus on the content. However, this appears to be how many parents and critics might view the situation. The content being taught is the "raw material" for teaching students how to learn, how to work with and how to think about mathematics knowledge.

The mathematics curriculum for the 21st century includes both the content and process skills that students need to learn in order to use mathematical ideas and transform them. Mathematics curriculum documents consequently include, and emphasise, skills such as critical analysis, reflection, and justification. Many parents are confused by this demanding approach as they expect the curriculum to be about computational skills such as addition and division, as it was in their day.

When computational skills are presented as being only a part of the mathematics curriculum, instead of the whole, some parents become alarmed. Indeed, some states and territories have had difficulties justifying new curriculum documents that emphasise higher-order meta-cognitive skills and which do not appear to emphasise mathematical computation. Parents, politicians and the media might think that the focus has moved too far towards process skills at the expense of content and this results in cries for "back to basics".

21st century "basics"

Cries for "back to basics" should now, I believe, be cries for "21st century basics" or perhaps "basics for the future". We do need basics in our school mathematics curriculum. These basics should include all those mathematical knowledges that parents have a right to expect their children to be taught and have access to during schooling. These basics for the 21st century include:

- high level cognitive skills concerning an understanding of numbers and how they work in a variety of contexts;
- understanding of operations and an ability to make choices about which ones to use in situations and contexts;
- ability to estimate mentally;
- ability to measure to identified degrees of accuracy;
- ability to perform calculations using a variety of methods including those using computational technologies;
- ability to judge the reasonableness of solutions obtained by self and others for the purpose of the situation and context;

- ability to communicate their "in the head" analysis and decision-making regarding judgements and choices for a variety of audiences and purposes (of which a maths test might be one);
- knowledge and understanding of spatial orientation including visual representation;
- analysis of and recognition of 2D and 3D shapes;
- recognition and analysis of functional relationships;
- dealing with and modelling uncertainty and analysis of data.

Clearly, these "21st century basics" include both mathematical content and the skills and processes needed to use and apply them. The "basics" from the '60s are but a very small, yet important, part of this list.

In conclusion

Teaching has become an extremely complex craft. Whereas in the '60s and '70s a teacher may have been able to merely transmit a list of topics and knowledge to a student and have "done their job", this is no longer adequate. Students who are taught mathematical knowledge and not the skills and processes they need to use to apply and use that content will neither be prepared to deal with the demands of life nor to participate effectively in a community, let alone contribute to the workforce.

As teachers, we need to be aware of the issues raised in this paper and to be able to converse in a professional and informed manner with parents who would have us focus on the basics of the '60s and '70s. It is our responsibility to educate parents about these matters, not give in to their requests. That is not to say that their demands cannot be met — students still need to compute and do division, for example, but these skills are not mathematical ends in themselves. The cognitive processes that sit around calculation skills are just as important, if not more so. They are also, in contrast to what the media and some commentators would have us believe, much more rigorous.

References

Bereiter, C. & Scardamalia, M. (1998). Beyond Blooms's taxonomy: Rethinking knowledge for the knowledge age. In A. Hargreaves et al. (Eds), *International Handbook of Educational Change*. London: Kluwer Academic Publishers.

Wells, G. (1999). *Dialogue Inquiry: Towards a Sociocultural Practice and Theory of Education*. Cambridge, UK: Cambridge University Press.

Investigation Ideas

While undertaking these investigations you should think about problem-solving strategies that will help your investigation: does drawing a diagram or using a list help? Investigate other numbers beside 9 and 15 that could be used to generate a new problem. You might also like to research the history of this type of problem (search for "schoolgirl problems").

- Nine schoolgirls plan three walks in a week. If the girls walk in three rows of three, how can they be arranged so that no girl walks with any of her schoolmates more than once in the week?
- Now for a greater challenge. Fifteen schoolgirls plan seven walks in a week. If the girls walk in five rows of three, how can they be arranged so that no girl walks with any of her schoolmates more than once in the week?