

Alan Bell

9 April 1929 to 5 April 2018

I have known Alan as a colleague and a friend for the more-than-forty years since I joined him at the Shell Centre for Mathematical Education. The Centre was created in 1967 by the University of Nottingham through the inspired efforts of the Professors of Pure and Applied Mathematics, Heini Halberstam and George Hall, in the wave of mathematics reform in the 1960s. Funded by a grant from Shell UK, they saw it as a regional institution to help teachers. Alan was one of the three full time staff, spending the rest of his long working life in the Centre.

Alan was born in Gravesend. His father, a joiner by trade, was a shipwright who became an inspector for the Admiralty during the Second World War. Alan was educated at Gillingham Grammar School, and briefly evacuated to Wales during the war - as children were at that time, to get away from "the Blitz". After National Service in Sudan and Ethiopia, he went to Peterhouse, Cambridge where he got a Double First in Mathematics in 1952. After teacher training at Bristol, he taught for 5 years at Mill Hill School before moving to lecture at Coventry College of Education, combining this with a research post at Birmingham University. In 1960 he was appointed Head of Mathematics at the new Nottingham College of Education in Clifton, now part of Nottingham Trent University.

He had already had established a national reputation through his work as an important member of the Association of Teachers of Mathematics. Founded by Caleb Gattegno, it was a young upstart organisation of teachers which focused on the learning activities of pupils, increasing student confidence as mathematicians through mathematical investigations. Alan wrote a chapter in the seminal book *Some Lessons in Mathematics*, created by the authors during a week long ATM workshop in Leicester, and still regarded as a classic. Alan contributed to many other ATM publications, before and after moving to the Shell Centre in 1967.

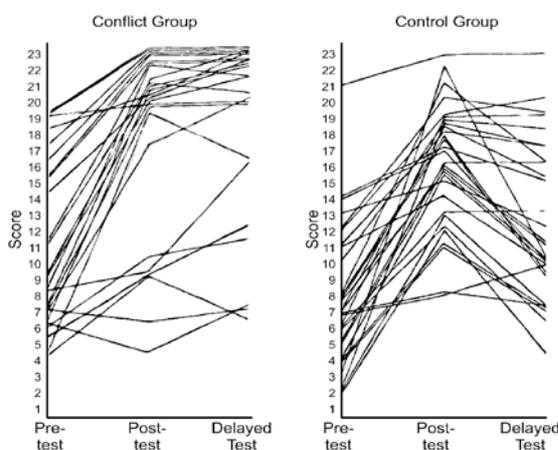
Like most mathematicians in that Post-Sputnik era, the creators of the Shell Centre believed that deepening teachers' understanding of mathematics was the key to improve pupils' learning, so the early years were focused on professional development. Alan, with his colleagues Bob Lindsay and Ruth Tobias (later, David Hale) led innovative professional development sessions for teachers across the East Midlands. These were well attended and popular.

However, Alan had a broader agenda based on his work on teaching with the ATM. In the early 1970s he started the South Nottinghamshire Project, working with two heads of maths in local secondary schools, David Rooke and Alan Wigley. They developed pioneering teaching materials for 11-14 year olds, based on a concept-focused investigative approach. These were published as *Journey into Maths*.

When I came as Director of the Shell Centre in 1976, I had learned enough, from experiments in teaching how to tackle real-world problems with mathematics, to know that improving teaching and learning is complex. I got the University to agree that the Shell Centre would become a research and development unit with the immodest goal of "improving the learning and teaching of mathematics regionally, nationally and internationally". Large-scale impact requires working through

reproducible materials, a design and development approach that Alan had already embarked on. We were able to recruit a young teacher with a genius for design, Malcolm Swan, to complete the core team whose work over the next 30 years became known worldwide, ultimately receiving the first Emma Castelnuovo Award of the International Commission for Mathematical Instruction for impact on "the practice of mathematics education".

Of Alan's many contributions to this work, perhaps the most important was the invention of "diagnostic teaching", an approach to formative assessment through carefully designed activities that produce "cognitive conflict", revealing to pupils their misunderstandings, then leading them to resolve through discussion how they arise and how to correct them. This ability to detect and debug your own thinking, *not* remembering exactly what to do, was shown to be the key to robust long-term learning (see graphs). In a sequence of projects through the 1980s, Alan and his research students showed this result was true across different topics with different designers – a crucial distinction between a specific treatment and a general design principle. Malcolm and the team developed this work further, culminating in the *Mathematics Assessment Project* which has had millions of downloads of lessons designed on these principles.



Alan sometimes seemed in 'absent minded professor' mode, occasionally in rather unsuitable situations involving traffic. He and Dorothy had driven to the big 1988 ICME Conference in Budapest. Towards the end of the week, Alan managed to have a tram - they have absolute right of way, and they use it - to have a tram catch a back corner of his car. It looked serious but Alan arranged to get it mobile again and continued to attend conference sessions and see the sights. And Kaye Stacey, a long-time collaborator wrote: "One of my most vivid memories was when Alan came to Melbourne after being slightly hit by a car in Sydney. His head was completely bandaged except for the eyes, nose and mouth. But he still came into the university each day. Frightened quite a few students in the lift." Alan's capacity to focus on what he saw as important, just sailing on through difficulties he saw as inessential served him well through to his final days.

Alan contributed to many other aspects of the research, design and development work of the Shell Centre team, in particular the domain frameworks for classifying tasks, and the studies of student performance in various genres of mathematical activity, notably proof. He was always looking for ways of encouraging richer mathematical activities in the classroom. He has lectured on these topics by invitation in many countries. He was invited to write a *Review of Research on Mathematical Education* for the UK Cockcroft committee whose report *Mathematics Counts* was widely influential. He continued to contribute to the field for many years

after his retirement, receiving a warm welcome from colleagues from around the world at the 2017 Shell Centre Jubilee Conference.

No tribute to Alan Bell can fail to include Dorothy, the dynamic woman whom he met at Cambridge. They finally 'got together' in London and were married in 1958. They were a partnership of complements with many achievements, notably their children Andy, Tony and Ruth of whom they were both so proud. Dorothy's death in 2006 was a huge blow to Alan and the family, but he lived on in their house in Lady Bay - and sang in two choirs a week - until just before he died on April 5 2018.

Hugh Burkhardt

May 2018