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Enfield College of Technology

Introduction

A lightly edited version of this article, without photographs, appears as Chapter 5 in Bourner and Crilly [2018], a book centered around Enfield College of Technology. It was part of the revolution in higher education fostered by members of both the Labour and Conservative parties, and which found expression in the Robbins Committee, set up by Harold Macmillan's government.

I am grateful to the editors of the book, Tom Bourner and Tony Crilly, who were both colleagues at Enfield, for the opportunity to tell something of my story.

Although certainly not unique, I was unusual in that I was a student on the Mathematics for Business, B.Sc., degree at Enfield College of Technology, and became a lecturer on the same degree the term after graduating. This article tells something of the story of my student life and working life, before, during and after Enfield¹.

Life Before Enfield

My parents were keen on the idea of comprehensive education, so whilst I passed the 11+ exam and had a place at a grammar school, I went to school at Mount Grace in Potters Bar, one of the first comprehensive schools in Middlesex, starting in 1953 the year after the school opened. Being an early comprehensive and a new school meant that many of the teachers were young and enthusiastic about the new system; something very much in common with Enfield College of Technology when I started there as a student. At school I very much enjoyed mathematics and somehow knew that my career would be in mathematics. I never regretted going to Mount Grace.

During, I think, my fourth year at Mount Grace, Vic Marchesi joined as a mathematics teacher and we became close lifetime friends. Although older than many of the new teachers, Vic certainly shared their enthusiasm for the comprehensive system. One of the teachers persuaded me to stay on at school to do a scholarship year, but it turned out that he was not actually capable of teaching to scholarship level. Nevertheless, I had a good year studying English literature and joining Vic as what we would now call a teaching assistant in his A Level classes. We also ran an evening class on Modern Mathematics for Parents at a time when topics that many parents were not familiar with, such as matrices and set theory, were being introduced into the syllabus. It was good fun and good experience for the future. Vic will appear again later.

I also first met my wife Pam at Mount Grace and we still see several friends from those days, so it holds plenty of happy memories.

I knew that I wanted to continue with mathematics after school, but guidance on university courses was somewhat limited. For reasons that I cannot now remember I decided upon Bangor in North Wales, perhaps they were the only college to offer me a place! So off I went on the train, new overcoat given by Mum up on the rack and there it stayed, perhaps

¹The photo on the title page shows the Broadbent Building at the entrance to the college. It is now a Grade II listed building.

still travelling! Nevertheless I thoroughly enjoyed life there and made good friends, but the course really did not suit me and to make matters worse, my father died just before my exams. The tutorial system at that time was non existent, so no one asked how I was coping. Anyway, after two years I failed the exams, perhaps my love of bridge didn't help!

I then spent a year doing various jobs, such as bar tending at my local pub, working in a book warehouse and supply teaching. How times have changed, it would be impossible now to teach without more than A Level qualifications. I loved my time at a primary school and I can imagine that if things had turned out differently I would have become a primary school mathematics teacher.

During the year Vic Marchesi told me about a new mathematics degree course, called Mathematics for Business, that was starting at Enfield College of Technology in Ponders End. The new degree sounded much more my cup of tea and so I made enquiries. I was accepted onto the course and, surprisingly, I was able to get another grant. What a contrast to today, I feel so sorry for the financial burden that students today have to suffer.

A Student at Enfield

Prior to 1964 colleges like Enfield, that did not have university status and hence a Royal Charter, but wanted to run degree courses typically offered external degrees from a university such as London. In 1964 the Council for National Academic Awards (CNAA) was established by Royal Charter and so was able to grant degrees. The Mathematics for Business degree, which started in 1964 must have been one of the first degrees anywhere to be approved.

The Principal, George Brosan, had been recruited in 1962 and together with his deputy, Eric Robinson, changed expectations as to what educational opportunities colleges, such as Enfield, might offer. See for example Robinson [1968]. The idea, of course also taken up by other colleges of technology, was to take comprehensive education into the colleges, to give everybody the opportunity to develop, flourish and have a full education irrespective of ability and talent. So, as well as degree courses, one could take various diploma courses and study part time and in the evenings. The colleges of technology were funded by the local authorities and there was a real sense of community. As far as I am concerned all that was lost when Margaret Thatcher sadly removed local authority control of the polytechnics, paving the way for converting the polytechnics into universities². Middlesex University seems to have been one of the more successful new universities, but the sense of local community has inevitably been lost.

At the time the Mathematics for Business course was an almost unique mathematics degree. The applied subjects in the degree included statistics, operational research, finance and econometrics. It also included computing and numerical analysis, which became the main subjects of my future career. The lecturers were all enthusiastic, mainly young and some just starting their careers. One notable exception was the wonderful Stanley (Stan) Millward who, soon after the war, joined what was then, I believe, Ponders End Technical Institute,

 $^{^2 \}rm Somewhat$ ironically, the new Roberts building, or tower block, was opened by Margaret Thatcher on Wednesday 17th March 1971.

shortly to become Enfield Technical College and, in 1962, Enfield College of Technology. Although I was not aware at the time, he had taught an amazingly wide range of subjects such as pure mathematics, physics, statistics, astronomy and engineering, and had even been a PT instructor. At the time of starting the Mathematics for Business course, the college did not have a numerical analysis specialist, so they had turned to Stan to teach the subject, which he agreed to do. I don't believe that any of us students realised that he had never taught the subject before! (See Picture 1.)



Picture 1: Stan Millward

Nine of us students started the course, but sadly just three of us finished with a degree, a B.Sc., so let no one say that CNAA degrees were easy. A Business Studies B.A. course started at the same time as Mathematics for Business, but did not receive official approval from the CNAA until 1965. It was typical of Brosan's optimism and enthusiasm that he would allow the course to start without approval. Picture 2 shows the students from the two courses attending the graduation ceremony held at Capel Manor, at the time rented by the college. Mel Williams and I are on the left of the picture, with me to the left of Mel. Sadly, the third graduate from the Mathematics for Business course, Hazel Chapman, was unable to attend³. As I recall, Mel went to the Milk Marketing Board using his operational research skills and at some point joined British Airways, where he had a stellar career.

I believe that it was in the second year of the course that we were able to take computer programming as an option. Once again, not having any other expert, Stan Millward agreed to take the course! The college also did not have its own computer, so we travelled either to Hatfield College of Technology to use their Elliot 803⁴, or to Elliot's themselves at Elstree.

 $^{^{3}\}mathrm{If}$ any one reading this knows of her, I would love to hear her news.

 $^{^{4}}$ According to Wikipedia Hatfield purchased a digital computer at a cost of £29,201 in 1962 so that a computer science degree could be established. Hatfield became a Polytechnic in 1969.



Picture 2: Enfield Graduates, 1968

We used a language called Algol 60, which was Europe's answer to Fortran and fed our programs into the computer on paper tape. I thought that Algol 60 was really a very nice language, but ultimately it could not compete with the IBM backed Fortran and it became obsolete. The actual computer that we used at Hatfield is now restored and in the National Museum of Computing at Bletchley Park. See Pictures 3 and 4. I am not sure if I should be pleased or depressed that the first computer I used is now in a museum! Either way, I am proud of the fact that I wrote and ran my first program in 1965. Elliott was close to the Elstree film studios and their magnetic tape bore a close resemblance to film tapes, see Picture 5.

In common with many CNAA degrees in those days, it was a four year course with the third year spent working in industry. I spent my industrial year at Arlington Motors, across the road from the college, working on a model for stock control. I don't believe that the results were ever used by Arlington's, but it was a very enjoyable experience. Hazel Chapman worked at Belling and Lee, and Mel Williams at Idris.

As Pam lived in Potters Bar and Stan Millward, who didn't drive, lived in nearby Brookmans Park, I often gave Stan a lift home in my 1949 Austin A40. I had stuck a number of labels in the car and Stan was convinced that it was the labels that held the car together! Stan was an inspiration to many of us at Enfield, both staff and students, and was another life long friend. Ray Barons, for many years a lecturer at Enfield, told me that when he first arrived his head of department was nowhere to be seen and had not asked anyone to show Ray around, but Stan took it on himself to do just that and Ray has never forgotten his generosity.

No doubt in large part due to Stan's teaching, I found a real enthusiasm for numerical analysis and, in particular, for numerical linear algebra. In the final year of the course we had to write a mini thesis and mine was entitled Latent Roots and Latent Vectors⁵. In

⁵Nowadays they are referred to as eigenvalues and eigenvectors.



Picture 3: Elliott 803



Picture 4: Hatfield Elliott



Picture 5: Elliott 803 Tapes

length mine was very much more than mini. The two external examiners for the course⁶ were Ernest Albasiny, Head of Mathematics at the National Physical Laboratory and Professor George Smith from Brunel University, who was an expert in PDEs. They seemed to have rather approved of the thesis and I was fortunate to obtain a first, mainly on the basis of the thesis. Much to my surprise they encouraged me to publish the thesis and, with further work, it was published as a book two years later, in 1970⁷. Much of the book is now very much out of date, but the experience was wonderful and rewarding⁸ and I think that it is testament to the college and the staff that it was possible.

A Lecturer at Enfield

At the end of the course I decided that numerical analysis and computing were what I wanted to continue with, and that I would like to be a lecturer. I was encouraged by Stan and others to apply to Enfield. I was short listed and called for an interview. After a long wait, wondering what was happening, George Brosan emerged and said "Chairman's option, you are appointed." and disappeared as quickly as he had appeared. Amazing!! It seemed to have upset the local councillor, who phoned me up later to interview me over the phone, but in any case there wasn't much he could do⁹.

Pam and I married on September 7th, 1968, had a week's honeymoon, about six miles away from where we now live, and I started work as a Lecturer on September 16th. I became a

⁶Yes! We had two.

⁷Hammarling [1970].

⁸Not financially, though!

 $^{^9{\}rm Of}$ course, now adays it would not be possible to get such a lecturing job without a Ph.D. so, in retrospect, I feel very privileged.

Senior Lecturer in 1971.

I loved lecturing and tutoring, principally in numerical analysis and computing. Enfield bought its own computer sometime in the late 1960s, a Honeywell 120 if I recall correctly and not really suited to an academic environment. Input was via punched cards, which we had to leave for computer operators to feed to the computer and collect our output sometime later. In the mid-70s, probably by the time the college became a polytechnic, Enfield bought a DEC PDP-10 computer¹⁰, which was a time sharing machine, much more suited to an academic environment and we could access it via a terminal! I wrote several user callable for routines for the DEC and still have the documentation for the linear equation solvers, as well as a guide I wrote for the DEC SOS editor. I also have a number of my numerical analysis lecture notes.

In 1970 Vic Marchesi left Mount Grace and came to Enfield College of Technology as a lecturer. As with Mount Grace, he was drawn by the new approach to further education. He taught mathematics on a number of courses, particularly engineering courses. Vic never had any pretensions about being a great mathematician, but he knew how to instil confidence in his students, especially those for whom mathematics did not come naturally. The students were always free to phone him and to visit him at home for tutorials. Vic and Candy's¹¹ home had many mementos from grateful students, a testament to how much they cared about him. To Middlesex's credit, they kept him on as a part time lecturer until his death, some thirteen years after his formal retirement. I am sure it gave a one time race course bookie cause to smile, knowing that he had become a university lecturer! Would a modern university take on such a teacher? I doubt it.

There were many communal activities at Enfield. Vic was a keen football supporter and player, playing well into his sixties and I remember that, until the football pitch was built on, we had a staff football team. Probably our best player was Bryan Davies¹², who left in 1974 when he was elected as a Labour MP for Enfield North. Vic was also instrumental in organising end of term get togethers for the staff, either at a restaurant, or often at someone's home. They were lovely occasions and helped us to get to know people from other departments and courses. He also organised the occasional end of term shows, which were great fun.

The college had a number of somewhat obsolete mechanical hand calculators¹³ and Stan, Vic and I, and maybe others, used to demonstrate them at the local schools, as one of the efforts to engage with the local community. The pupils seemed to really enjoy using the calculators and it was not unusual to find a pupil, who apparently had been having difficulty with arithmetic, suddenly understanding the process when seeing it in action on the calculator¹⁴. It reinforced the knowledge that some students can need a different perspective when learning a subject.

Stan Millward formally retired in 1971, but also continued part time until finally retiring

¹⁰Again, if I recall correctly.

¹¹Vic's wife of 55 years.

 $^{^{12}\}mathrm{He}$ became Lord Davies in 1997.

 $^{^{13}\}mathrm{Operated}$ by hand, rather than being held in the hand!

¹⁴The ubiquitous modern electronic calculators and computers are wonderful developments, but we have largely lost the ability to see the processes in action.

in 1976 and even after that coming in for the occasional guest lecture. He was the epitome of a gentleman. He also had a wonderful sense of humour. In the days of chalk that was supposed not to produce dust, I remember another lecturer called Charlie Dust coming into Stan's class to ask if he had any spare chalk. Stan as quick as a flash said "Ah, the chalkless Dust!". One day when Stan had an optician's appointment, Vic and I drew arrows on the floor from Stan's room in the temporary huts towards the opticians in Ponders End. Thankfully, Stan enjoyed the joke¹⁵. I know that Tony Crilly also saw Stan regularly after his retirement and they worked together producing, I think two papers¹⁶, a great help in keeping Stan stimulated.

I have concentrated on two of the people who were particularly important to me, but of course there were many others who contributed to the success of the college, such as Bill Craze who was in charge of the Mathematics for Business course when I started; another person who cared deeply about the students, including making provision for disabled students and late developers. Picture 6 shows Vic Marchesi, myself, Bill Craze and Stan Millward with, I believe, Sofron Sofroniou in the background.



Picture 6: Colleagues at Enfield

A notable feature of that time were the discussions, or even arguments. We had plenty of them, but unlike later times when Brosan and Robinson had left¹⁷, they were about educational issues and student needs. It was a wonderful place for me to start my career.

¹⁵The temporary huts were not so temporary, they were there for many years!

¹⁶Crilly and Millward [1988], Crilly and Millward [1992].

¹⁷They became respectively Director and Deputy Director of North East London Polytechnic in 1970.

Life After Enfield College of Technology

I am going a bit beyond my remit, to say a little about Enfield when it became part of Middlesex Polytechnic, particularly topics that were important to me. Enfield College of Technology became part of Middlesex Polytechnic in 1973, initially combining Enfield, Hendon College of Technology and Hornsey College of Art.

Initially, life and the ethos at Enfield did not change too much and even well into Polytechnic days, the staff at Enfield continued to try to engage with the local community and to have the education of students at its heart. For example, in the spring of 1976 Tony Crilly and I launched Middlesex Mathematical Notes, aiming at one issue per term, which was usually achieved! It was aimed at students and staff with an interest in mathematics and we also distributed copies to the local secondary schools. See Picture 7. Tony kept it going until



Picture 7: Middlesex Mathematical Notes

1982.

In 1977, in large part due to Bill Craze, we enrolled the Polytechnic's first blind student, Paul Holliman, onto the Mathematics for Business course. I think that it is fair to say that it was a humbling, but fulfilling experience for those of us involved. There were, of course, challenges, principally in turning written notes and computer output into forms suitable for Paul, as well as thinking about appropriate teaching methods, something that I am sure we as teachers benefited from. To its credit, the Polytechnic agreed to purchase a Braille printer for the computer, not a cheap option, and many of the staff put notes onto cassette for Paul. Notably, Stan Millward, who had retired by then, and Ivor Gratton-Guinness devoted considerable time to helping Paul. Ivor and Paul subsequently wrote an article about the experience 18.

But over time, the fact that the college was no longer on one site and was in more than one community did have an effect. The discussions and arguments seemed to move away from education. Andrew Roberts points out, on his web page about the history of Middlesex University¹⁹, that the first edition of the Polytechnic newsletter, North Circular, in 1973 had the Headline "Row brews over faculty boards". Sadly, that sort of discussion seemed, all too often, to replace discussion on student education.

Life After Middlesex Polytechnic

Thanks to the external examiner, Ernest Albasiny, I was given the opportunity to have a sabbatical year at the National Physical Laboratory with James (Jim) Hardy Wilkinson, which I happily took in 1975. Although I am not sure I realised at the time what an honour it was, the experience changed the course of my career. Working with Jim increased my desire to do more research and in 1979, on Jim's retirement, I left Middlesex Polytechnic to take up a three year contract as a Principal Research Fellow at the NPL, working with Jim's small group. At the same time, Paul Holliman spent his industrial year with us at NPL. If I remember correctly, Paul achieved a 2.1.

Soon after acquiring the VAX computer the college installed the NAG²⁰ Library, a collection of numerical and statistical routines for solving numerical problems, which at that time was free to colleges. We used the Library on the Mathematics for Business course in the teaching of numerical analysis and, of course, people could use the Library for their research problems. NAG started in 1970 as a university project funded by the then Computer Board, releasing its first Library in 1971, but was spawned off in 1976 as a not for profit company. In about 1974, or so, whilst at Enfield, I contributed routines for the singular value decomposition to the Library and in 1976 became a member of NAG, thereby pledging £1 if the company should go bust!

At the end of my contract at NPL in 1982, I joined NAG and remained there for the next 32 years, the last seven working part time, still computing and working on numerical analysis. NAG encouraged collaboration with academia and being non profit, the emphasis was on the technical work, both of which suited me very well. I was still able to give occasional lectures and indeed was lucky enough to hold a visiting professorship for twenty years at Cranfield University, Shrivenham. From 1994 to 1997 I was even a member of the Science and Engineering Faculty Advisory Group at Middlesex University! In 2006 I became an Honorary Senior Research Fellow at the University of Manchester²¹, a position I still hold (and love) at the time of writing, so I retain a strong contact with academia²².

NAG even encouraged a colleague and myself to be involved in open source software development for numerical linear algebra, developing a de facto standard for a set of Basic

¹⁸Grattan-Guinness and Holliman [1983].

¹⁹http://studymore.org.uk/ssctim.htm.

²⁰The Numerical Algorithms Group.

²¹http://www.maths.manchester.ac.uk/~sven/

²²It is hard to overstate how lucky and proud I feel to have been involved with the numerical analysis group at Manchester.

Linear Algebra Subroutines (BLAS)²³, followed by a linear algebra package called LAPACK to utilise the BLAS²⁴. At the time of writing, the software is widely used worldwide and is included in the libraries of chip manufacturers, such as Intel²⁵ and AMD²⁶, as well as in many packages such as MATLAB. LAPACK is a project that I am particularly proud to have been involved with; an interest in numerical software that started in 1965 at Enfield. Like Enfield, there was a wonderful camaraderie at NAG and I loved the work. At the time of writing, I still have an honorary position at NAG.

I could not have been successful at NPL and NAG, and been involved in academia and projects such as LAPACK without the educational opportunities that Enfield College of Technology provided in those magical years. I am eternally grateful.

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²³https://en.wikipedia.org/wiki/Basic_Linear_Algebra_Subprograms.

²⁴http://www.netlib.org/lapack/, https://en.wikipedia.org/wiki/LAPACK.

²⁵Math Kernel Library (MKL).

²⁶AMD Core Math Library (ACML).