Physics Teaching at The University of Adelaide 1950s to 21st Century

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It’s a privilege and a compliment to be asked to present this talk surveying our Department’s teaching over the past sixty years.

As one gets older, one gains a greater interest in older things and people – Sophia Loren or Judy Dench for example, instead of Miranda Kerr or Angelina Joli.

In 1959, when I enrolled in Physics I, George Fuller signed my enrolment form, Sir Mellis Napier was Chancellor, Henry Basten was Vice Chancellor, Leonard Huxley was the Elder Professor of Physics, John Jenkin, a third year physics student, was President of the Students’ Representative Council. Rod Jory, an honours student, who marked our weekend papers, was president of the Science Association. Occasionally, I saw retired reader Roy Burdon collecting his mail. I paid my student union fee in the front office of the Mitchell Building where Vic Edgeloe, the Registrar, had his Office.

Life was exciting, but pretty laid back.

Orientation week was delayed to allow the students doing their national service time to finish their training. We had an ecumenical commencement service in the Bonython Hall. Our introductory Physics I lecture was just under 200 students, mostly male, given by David Sutton in the old Prince of Wales lecture theatre, where the Wills building now stands.

We bought our text books at the tiny WEA book shop stacked high with books and very crowded. It was a small stone building on the lane next to the Art Gallery.

There was a tree-lined parking area with possums where the Hughes Building now stands, and the old stone Anatomy building and cross campus roadway were where the Central Hub now is. Farther around, where the Bragg Laboratories are, there was an animal enclosure with at least a few kangaroos and other assorted animals.

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Fig1. WEA bookshop later demolished.
In 1961 we had lectures from Harry Medlin in the new observatory lecture theatre. The old observatory on West Terrace had been demolished in the 1950s and there was renewed interest in tracking Sputnik satellites.

Some students matriculated with Leaving then, although most had Leaving Honours and went straight into Physics I, while the others went into General Physics. There was a separate physics course for first year medical and dental students. A year or two later, these students did Physics I as did the engineers.

It was the end of an era, the beginning of a new one.

Teaching is our bread and butter. It has governed our funding and staff numbers through the years and attracted postgraduates to research. We always faced competition, mainly from mathematics and chemistry, for the best students.

Teaching has gone through enormous changes in that time, but the main emphasis has always been to communicate our understanding and curiosity for the subject to our students, and to help them overcome their difficulties and mental blocks that would prevent them from becoming successful physicists.

On the way I have been inspired and enthused by my association with the distinguished physicists around me. John Carver, Bert Green, Tony Thomas and John Prescott, all come high on my list, as do my early lecturers like David Sutton and Harry Medlin, and the many students I have been associated with, some of whom still confront me in Rundle Mall or at the Festival Theatre, to remind me I was once their lecturer.

I worked with John Prescott quite closely, in research and teaching. I team-taught medical physics with him for a year and learnt a lot from him. I worked with him in the first year laboratories, where he made a point of demonstrating for 3 hours a week for a number of years. He and I alternated in teaching third year optics for several years prior to Jesper Munch’s arrival. He gave me much good advice on lecture demonstrations, which I thought he excelled at.

I have no doubt, were he still with us, he would be giving this talk.

John once said to the medical physics class that the only physicist whose middle name he expected them to remember was James Prescott Joule, after whom the energy unit is named. He had a poster on his notice board presented to him by his Calgary students when he left. It was heart-shaped with faded streamers hanging down from it and it read: “James Prescott, you are a Joule.”

John Prescott of course is well known for his annual survey of physics employment trends that he published in the Australian Physicist.
I think John Carver showed this department great academic leadership over the period 1961 to 1979. I knew him as a student when he arrived and again when I became a junior staff member in 1969, and I respected him greatly. He turned the department around in 1961 and gave it a new direction with new research initiatives and good teaching.

He arrived from Canberra towards the end of my third year when I had already decided to do honours. We were all curious about the new professor from the Department of Nuclear Physics at ANU, so it was a real privilege to be invited for morning tea with other prospective honours students into his office, which he inherited from Professor Huxley, near the present Huxley Laboratory. He used the occasion to get to know us. I remember he asked, “How do we know that nuclei have energy levels?”, and Alastair Blake of course gave the correct answer “from their gamma ray spectra”.

Professor Carver had a great guiding philosophy. Physics should be 10% of the University, in number of students, funding, and research output. He did his best to realize that ideal and we were caught up in his endeavour. He used to hold annual Department Review Meetings in the Bragg lecture theatre and nearly everyone would attend: staff, students, the workshop boys and the girls from the office. Peter Van Rood his Executive Officer was there. Peter had been a Spitfire pilot during the war and he had a photo of him over his desk, flying his plane with an RAF roundel and the insignia AVR.

At the end John Carver would produce a bundle of research papers, and a stack of PhD theses, and take the total department income and divide it first by the number of papers and theses then by the number of graduates and tell us the cost per publication, and cost per graduate and how it compared with previous years.

Another initiative John Carver introduced was a Summer School for high school students starting year 12, selected by their schools as their top students. It was held over three days in January in the Bragg lecture theatre and the weather was usually hot. There were roughly equal numbers of boys and girls, who came in bright eyed and bushy tailed and literally feasted on a series of talks about physics, usually at least one with lecture demonstrations.

The first duty I had in the Department was to co-ordinate the 1969 Summer School and I gave one of the talks on Stellar Nuclear Reactions which I had been working on at Caltech, so I could give some first hand information about what modern experimental research was like. The students always gave the speakers an enthusiastic response with questions and applause. It was a great experience.

Clem Appleby would get the old cloud chamber going and there would be lines of students to stare at the alpha particle tracks. I think it wore out later. There was usually a key-note speaker. In 1970, it was Prof Titterton from ANU who gave a
brilliant demonstration lecture on electromagnetism with rings shooting up to the ceiling and nails glowing red hot and melting.

John Prescott gave a clever demonstration lecture called “Physics Through the Looking Glass”. He began by reading the first page of Lewis Carroll’s book. His lecture dealt with mirror symmetries in the laws of physics. A particularly nice demonstration was optical rotation of polarized light by levulose as well as ordinary sugar, or dextrose.

Bob Culver from Engineering was a favourite speaker for many years. He gave a talk that always included a flamboyant demonstration with lots of water, sometimes bricks which he relished smashing. On one occasion he had a big pile of 44 gallon drums on the stage of the Scott theatre covered by a tarpaulin. During the talk he tugged the tarpaulin off and said “That is how much water the average household in Adelaide uses every day!”

Another time Alastair Blake gave a marvellous talk showing how computer circuits add and multiply numbers using flashing lights. The students loved these action packed talks.

In the early seventies, Sir Mark Oliphant, who was then our governor, gave a speech to the Summer School and presented John Carver and the Department with a signed photograph of Albert Einstein.

The summer school always concluded with a Brains Trust panel where the lecturers sat at the front, and the students could ask any question they liked. I remember Titterton started the ball rolling with question “Who is going to win the Adelaide Cricket Test against the Poms?” His a cricket buff of course and actually gave a good analysis of the two teams.

For many years, we had only four physics courses: Physics I, II, III and IV or Honours. Gradually variations were introduced like IIIM courses in the 1960s. Instead of doing just Physics III and Applied III, or Mathematical Physics A as I did, you could now do Physics IIIM as your second subject and include some chemistry, maths or mathematical physics, or geology. Our present Professor John Carver recalled to me the other day how much he enjoyed Physics IIIM with half physics and half chemistry.

Over a period of years, courses became more unitized to facilitate this mix. The transition to units from second year on was completed with the change from three terms to two semesters which occurred in 1989.

In 1959, there were few handouts, and they were copied on a roneo machine as were all the practical notes which had hardly changed in years. They were difficult to correct and some were old and in a terrible state. We had a challenging time of it and relied pretty heavily on our own lecture notes.
Overhead projectors came in around the mid 1970s. I thought them very useful for diagrams and tables. Powerpoints came in the 90s. Now they are even used in schools. These days, I think most notes are put online on MyUni, which saves a lot of paper and paper aeroplanes.

I enjoyed Physics I. David Sutton started us off with mechanics and he was a good lecturer. We were all sad when he passed away in 1981. Then I think came Stan Tomlin, on Heat. He had a rather English formality, but was a well organized lecturer. Then came Professor Huxley for Electricity and Magnetism, or Graham Elford if you were in the evening class, followed by Harry Medlin on Modern Physics and Bob Crompton who finished the year with Geometric Optics. When he called us back for a final lecture during “swot vac”, we all knew that material would be in the final exam.

The old physics courses of the early 1950s had been replaced by more modern courses in relativity, quantum mechanics, solid state and atomic and nuclear physics, mainly as a result of people like Stan Tomlin and Harry Medlin.

Only Professor Huxley gave us notes. His electric circuits had little earth shields on them (due to his slow electron research) and capacitors which floated above the earth like balloons. The Department owes a great deal to his research perspicacity, although his own research group moved to ANU with him.

Our third year course in Mathematical Physics A was a beauty. It was taught by Bert Green and Ian McCarthy. Bert taught Relativity, Particle Physics with Feynman diagrams and Caratheodory’s statistical thermodynamics. Ian taught Quantum Mechanics out of Dirac’s textbook and we waded through bras and kets and matrix operators. He also did Nuclear Theory with shell model wave functions, as I am sure Tony would know. Professor Ren Potts from Applied Mathematics, gave a course on vectors and tensors.

Our first year practicals were 13 off, including one spare, of supposedly identical pieces of apparatus in a laboratory hosted by a demonstrator who marked our work before we left. My first was the Chronograph experiment. There were 13 huge lead balls hanging by V-wires from the ceiling of the laboratory, with a pointer blipping through a small pool of mercury to complete a circuit and record the blips on a rotating paper chart called a chronograph. It was an easy experiment and I got a good value of “g”. The demonstrator was Vic Mitchnick, one of Stan Tomlin’s PhD students. He was well known as VM α+ , and laughed when I reminded him of this years later.

When John Carver arrived he saw what a waste of valuable research space these teaching laboratories were and arranged for the Bragg Laboratories and new lecture theatre to be built in 1962, less than a year after he arrived. I believe it is still the only university building to be finished on time and on budget.
It also provided an opportunity to change the way the practicals ran. Instead of 13 off we had floors with a variety of experiments, two or three of a kind. They were better quality and took longer than three hours to complete. An element of design was introduced. We also had a system of marking and included the practicals as 25% of the final mark. Practical books of notes replaced the tatty roneoed sheets.

Gradually more and more projects were introduced in place of set piece experiments.

By 1969, we had innovative practical electronic courses in third year and honours. The new electronic practicals included integrated circuits: “op amps” and transistors in third year, and digital devices in honours, and we made little computer circuits. Don Creighton from the Mawson Institute ran the honours course and Don McCoy, the third year one. They were popular and many staff members including myself did the honours course.

In 1962, we had some new honours lecture courses: John Carver on Nuclear Physics, Basil Briggs, Atmospheric Physics and Dr Bell on leave from ANU on Astrophysics. It was a memorable year. Alastair Blake and Ron Ekers were in it. Alastair became Executive Dean of Science and Ron became Director of the Australia Telescope National Facility and originator of the Square Kilometer Array.

During my undergraduate years, I went to several of the annual Einstein Memorial lectures in the Bonython Hall hosted by the Australian Institute of Physics of which Dick Johnson, who worked for many years in the second year laboratories, was local President. The 1961 lecture was memorable, being given by Sir Lawrence Bragg during his only return visit to Australia.

I also went to Science Dinners and heard Professor Kerr Grant who was in his 80s, recite Rudyard Kipling’s poem “If”, in his inimitable hare-lipped voice. He had added a new verse:

“If you can find a way to smash the atom
And yet not build the bits into a bomb
If you can say “Well I a democrat am”,
And yet see something human in a com.
If in the Brave New World’s big University
You sometimes find your weekend papers stiff
Perhaps ‘twill help you overcome adversity
If thinking of this day you think of “If”.

When I returned in 1969, we had a second experimental professor, Ken McCracken. He left at the end of 1970 and John Prescott and Roger Clay arrived about 1972. The Department went from strength to strength.
About 1982, Professor Tony Thomas was appointed and in 1987, a new teaching initiative appeared in the Calendar. It was a Co-operative Program with industry later called EPIC: Education in Physics with Industry Co-operation, which the best physics students could undertake from 2nd year on. It extended the number of years for a B Sc from three to four, and allowed a term off each year to work full time in industry and be paid for it. Students would gain valuable experience and an entry to a guaranteed job on graduation. It ran for about 5 years with moderate success. It was a nice idea and showed the effort the department was prepared to take to assist its students.

When I was a student in 1959, we were mostly on Commonwealth scholarships, or teaching scholarships from the Education Dept. Some paid their way, and relied on summer jobs to get by. During the early 1970s, there was a significant push to make tertiary education in Australia more accessible and equitable, so the Whitlam Government abolished university fees from 1974. This decision did not greatly change the socio-economic backgrounds of students because by then only 20 to 25 percent of students paid fees. Nevertheless the withdrawal rate shot up so that in 1984 a quarter of students who started Physics I withdrew.

In 1989 the Hawke - Dawkins revolution brought in HECS and fees were back, albeit deferred for most students. Suddenly students became customers who could complain vigorously if they didn’t like their experience.

In 1975, the Advisory Centre for University Education was set up with Bill Hall and Bob Cannon to act as a teaching resource centre. The Student Evaluation of Teaching Questionnaires made their appearance, first voluntary then required for promotion.

Let us look at the numbers of Physics I students over the years in figure 2. In the late 1960s and 1970s, the baby boomers went through and classes bulged for about ten years. Physics I went from two lectures to three lectures a day, Mondays, Wednesdays and Fridays. They were big classes and quite rowdy. Most engineering students, except the chemical engineers, did Physics I. After 1980, the numbers settled down, until in the 1990s, we lost the service courses as funding changed within the university and SACE was introduced. Physics I enrolments slumped which gave rise to budget and staffing problems.

New initiatives to restore the balance were introduced: PLES – Physics for the Life and Earth Sciences, with enrolments around 120 students, and a change to tutorials called Studio Physics, was introduced by Judith Pollard. Astronomy 1H, and “Physics Ideas and Society” for arts students, which were brought in much earlier, helped to stabilize our numbers.
Figure 2 shows the number of Physics I students each year from 1959 to 2010.

Unlike Physics I, the number of honours physics and mathematical physics students do not show the baby boom, but fluctuate Poisson-like around an average of about 10.

Figure 3 shows the number of honours physics students fluctuates more or less randomly.
Similarly the number of mathematical physics students seems rather random. The two departments merged in 1988 following the retirement of Professors Green and Hurst.

Figure 4 shows the number of mathematical physics honours students from 1959 to 2010.

I’d like to say something about the initiatives in Medical Physics, because I was closely involved with them. They began in 1976, when John Prescott asked me to team teach with him first year physics to medical and dental students. This was a long running service course which had come in for a lot of criticism and was cut back that year to a half subject. Our brief was to avoid it being scrapped entirely. We had good support in this from physiology professor John Veale who helped John and me to team teach it. We were “the three Johns” and it became quite confusing at times. We set out to teach a more applied course, but with good basic physics, including lecture demonstrations. I found it chaotic but I think the students enjoyed it.

Unfortunately, we decided not to cancel the lecture on “Prosh Day”, the last day of second term when the students had their street procession – it was a big mistake! The students had whistles, funny hats, chickens, rabbits and a barrage of paper planes. We lasted 5 minutes. It was the only time I saw John Prescott ruffled!

John handed it over to me and I continued to teach it most years until it was finally dropped from medicine in 1993, but I continued to teach a course called Aspects of Basic Physics to first year dental students until 2008. Between 1990 and 1992 I asked Dr Alun Beddoe, who had recently arrived as Chief Physicist at Royal Adelaide Hospital, to teach the radiation and nuclear part of the course.
Alun began to offer honours and PhD projects to our students as well to a small number of University of SA students. He had an excellent PhD candidate, Paul Keall, from the University of Waikato. Paul later became Professor of Medical Physics at Stanford and Sydney Universities.

In 1992, Alun Beddoe, David Paix from University of SA and I set up the first joint M Sc (Medical Physics) coursework degree, with a research project as one of the units.

In 1995 Alun Beddoe left to take up the chair of Radiotherapy Physics at the University of Birmingham. Dr Sergei Zavgorodni and I continued to supervise the students, with emails from Alun, until Tim van Doorn was appointed two years later. Since its inception, our program has continued to expand, and our graduates are scattered all around Australia, New Zealand and SE Asia, even Romania and Iran, mainly in hospitals as Chief Physicists or Senior Physicists and some universities. They include a number of full fee overseas students. Altogether we now have 12 PhDs completed, along with 23 M Sc(Medical Physics) coursework masters degrees completed, and more in the pipeline.

From our first batch of M Sc's, the present Chief Physicist, Associate Professor Eva Bezak graduated in 1995 and went to ANU where she completed her PhD under Nuclear Physics Professor George Dracoulis. We thank Tony Thomas for initiating the adjunct Associate Professorship in this department, held by all three Chief Physicists. It has given the program a significant position at the Hospital which provides much of the funding to run the program. I am proud to have been involved in this initiative.
I have genuinely enjoyed my teaching experiences. I read biographies and learned recently that Einstein didn’t need Michelson Morley to tell him there was no ether. His concept of “photons” in the photo-electric effect made that clear.

Another thing I have learned is that the more things change, the more they stay the same. We just get a little older! And finally a recent innovation…

Figure 6. The Hub Central next to the Barr Smith Library—beloved by today’s students 2012.