Education, education
Why teaching physics might be the career for you and how to get the training you need
Most physics graduates have an idea of what it’s like to be a physics teacher, having been taught by one in the recent past. Indeed, some may even be in physics today thanks to a particularly inspiring teacher. But not enough graduates consider teaching as a potential career option. Find out how you can become a physics teacher in the UK and hear from classroom teachers Cara Hutton and Dave Gash on how and why they made the choice to become educators and what the job involves.

Physics can be a complex and demanding subject. Whether it’s the latest research updates from the world of nanotechnology or the newest results from the Large Hadron Collider, understanding such advances and the basics that they are built on is no mean feat. Explaining these concepts to students is even harder, and specialist physics teachers are needed more than ever to ensure that enough students are encouraged to go into physics to take up the many exciting opportunities on offer. And although many countries face a shortage of specialist physics teachers, there are now lots of recruitment initiatives and programmes to help physicists to become teachers and to give non-specialist physics teachers the skills to teach physics with confidence.

A good teacher can invoke a passion for a subject from an early age, arming students with the knowledge and confidence to pursue it in the future. When it comes to the sciences, and especially physics, there is often a misconception that the field is impenetrable or beyond the grasp of the average student. But who better than an actual physicist to convince them otherwise, and help shape the next generation of physicists.

A good teacher can also be a good mentor. Just the other day I came across my notes from my first placement and saw that after I did my very first starter activity in a lesson, a year 7 (ages 11–12) boy came up to me and said “That was really good Miss! I’m looking forward to next time!”

I love that every day is different. I can teach the same lesson to two separate classes and know it will be different because of the questions the two classes will ask. The best thing is always the pupils. I know at the end of the year that I will have helped them understand more than they did at the start and given them a better choice in life because of it.

I was 20 when I was accepted by the University of Liverpool to study physics. I honestly didn’t take the course seriously at first, despite deeply enjoying its content, and I had no clue what direction it would eventually take me in. That’s when a couple of other students on the course said they were going to go into teaching. My life changed forever.

The PGCE course connected me with like-minded people. It unlocked a thirst for learning that was lacking in my previous incarnations. I was actually quite an insecure and shy individual and I remember shaking when I went for the interview for the course. My first day at my first placement school was even more terrifying. Fortunately, I was “team teaching” a group of year 7 students along with another trainee teacher, so we supported each other through it. As a physics specialist, I was very much in demand and I was able to quickly secure a job. Within 18 months, I had been given the role of A-level physics co-ordinator for my school, and I was formally promoted to co-ordinator-level the following year.

Fast-forward eight years and I am now the head of science at the same school and I absolutely love it. In the intervening years, I met my wife, who is a drama teacher at my school, and I was formally promoted to head of A-level physics co-ordinator for my school. I then went on to gain a PGCE at Liverpool and has recently completed a Master’s degree for 10 years. He is the head of science at Gateacre School in Liverpool and has recently completed a Master’s degree in education (leadership and management).
A major concern in physics education today is the large gap in the sector for well-qualified, skilled, physics graduates who have a passion for teaching. While there are plenty of driven physics teachers nationwide, we are easily outnumbered by our colleagues in biology and chemistry and they often end up teaching GCSE and A-level physics due to the current shortage.

If you are wondering what constitutes a typical day as a teacher, there is no such thing! Other than following my teaching timetable and planning my lessons for the week, it is very difficult to offer such an overview, given how unique each day truly is. This is one of the best parts of the job – not knowing where the day will take you. What I can say is that I know full well that I enjoy each and every moment.

I personally had very old-school ideas about what a physics teacher does when I first entered the profession. The reality has been so different. Working through experiments and exciting demonstrations – my laboratory ceiling now needs a few coats of paint – going on school trips to CERN and Jodrell Bank, and running competitions with other schools are all a part of a rich and varied job that allows me to be both creative and academic.

Working with children is incredibly rewarding and surprising. I am paid to teach young people about science and help them to understand the universe around them. Yes, it is hard work and there are a lot of things that I would change about education in the UK if I had the power. However, those things pale into insignificance when my students arrive and sit awaiting their next exciting experience in my classroom.

Routes to take

If you are considering becoming a qualified physics teacher in the UK, there are several possible routes. A small number of universities in England, Scotland and Wales offer undergraduate degrees in physics or science leading to Qualified Teacher Status (QTS), but the majority of teachers obtain this status by training in postgraduate programmes. Postgraduates can either specialize in physics with science or physics with maths and there are two main routes: university-led training and school-led training (see box above right).

University-led training is usually taken as a one-year full-time programme (though part-time options that take longer are also available), leading to a qualification such as a Postgraduate Certificate in Education (PGCE) or a Postgraduate Diploma in Education (PGDE). These courses involve a mixture of training at a higher-education institution and at least 24 weeks spent teaching in schools, usually carried out at two placements in different schools.

As for school-led training (generally only available in England) it can lead to a PGCE or equivalent in a number of ways. The School Direct programme places candidates (who may be paid or unpaid) in a school that will deliver training tailored to the trainee’s and the school’s needs. An alternative, known as School Centred Initial Teacher Training (SCITT), takes places within a group of neighbouring schools, with a lead school taking overall responsibility for a trainee’s development.

You can apply for a place on an undergraduate or postgraduate course via the Universities and Colleges Admissions Service (UCAS), which manages applications to UK full-time higher-education courses. There is a further route for postgraduates in England called Researchers in Schools, which is a three-year bespoke, salaried teacher-training course for candidates who have completed (or are finishing) their PhD.

Whatever your route into teaching, once you’ve finished your training, you’ll be classified as a newly qualified teacher (NOT) and will spend your first year in the classroom with a reduced timetable. In England and Wales, QTS is only required for teachers in local-authority state schools. However, schools outside the control of local authorities – such as independent schools – also prefer to recruit qualified teachers. Also, career options for teachers are significantly better if they have QTS.

The Institute of Physics (which publishes Physics World) works in a number of ways to improve physics education, by helping with the recruitment and retention of specialist physics teachers. The Institute’s Teacher Training Scholarships programme has been running for over five years. In 2017/18 it will offer £30,000 tax-free funding and support to 150 talented individuals entering physics teacher training in England. The Institute’s School Experience Programme can help you find a school that will allow you to spend some time there observing physics lessons. The Institute also offers support to teachers of physics throughout their careers, from workshops and events to teaching resources and tailored continuous professional development.
Leadership lessons learnt in the lab

Skills learnt as part of a research team translate well to a career as a leader in education says physicist and headteacher Mark Whalley

Much is written about the shortage of physics graduates entering teaching, about how many children are never taught physics by a subject-specialist and about the need for more pupils to pursue physics beyond school. But there is another area of crisis in schools and that is leadership. Filling leadership posts is becoming increasingly challenging, especially at the top of the profession. Now is a time full of opportunities and for those with the potential and the skills, leadership in schools could be the perfect career path.

There are opportunities for the full range of physics graduates in teaching, but for those with research or postgraduate experience the prospects may be even better. Reflecting on my own career, the PhD itself wasn’t the key factor in helping me move up the different levels of the education profession. Instead it was the range of skills gained during that postgraduate degree that laid the foundations for leadership success.

After graduating in 1990 I spent three years doing a PhD in particle physics at the University of Birmingham, UK, while working on the OPAL experiment at the Large Electron–Positron Collider at the CERN particle-physics laboratory in Geneva, Switzerland. After receiving my doctorate, I trained to be a teacher for a year before returning to do a postdoctoral degree in biophysics. Three years later, I began my teaching career in a challenging comprehensive (secondary) school. Within a year or so, I had my first low-level leadership role as an assistant headteacher in a large school, reaching headship four years ago.

Despite leaving research for a full-time career as an educator, it was my experience while still a part of research teams that equipped me with key skills and ultimately helped forge my leadership. At the heart of my research life was the teamwork necessary for the functioning of any experimental project. The size of a team varied over my research life, from small teams of three to large detector groups at CERN. A common factor in any of these settings that amazed me, and still does, was the level of democracy and inclusiveness shown within the team. Young, inexperienced voices were heard and given the opportunity to speak by those with years of expertise, acknowledging that age on its own was no guarantee of creativity and innovation. While the implicit hierarchy was always there – maintained by respect for those above you – everyone felt valued and a part of something bigger.

The lessons learnt during that time have served me well throughout my school leadership career. Collaborative approaches within leadership engender shared ownership and this, in turn, ensures all those in a team feel valued. Treating those who work for you as intellectual equals produces commitment, while failure to do so produces resentment. The best leaders in education know this, and they share their authority, invest in their colleagues and place faith in the ability of others. The worst exercise power, alienate their colleagues and encourage division rather than unity.

But there are a range of other skills developed in my research years that are worth mentioning. Effective school leaders must be analytical. Though much of school leadership is about “soft skills”, and there is still a great deal that is analytical. Judging pupil performance and teacher effectiveness, handling budgets and writing timetables all require a logical and analytical mind. As the job often entails having to deal with challenging “human” issues involving children, parents and staff, one benefits from a calm, rational and analytical approach. Schools themselves operate within legal, social and technical frameworks and dealing with the requirements of inspections, legislation and even school-management systems all benefit from detached and abstract approaches often found in the world of research.

School leaders must also be extremely comfortable with data. Don’t get me wrong, I would not suggest that the data processing required in a school equates to that required at the Large Hadron Collider, but the ability to confidently and reliably handle and interpret large data sets is a key skill of a leader in education. Many, if not most, schools are data-driven and mastery of data analysis and statistics will give you a distinct advantage over colleagues with less experience in the area. Data are the life-blood of schools and, though often shunned as the impersonal and regrettable side of the profession, they are at the heart of education and unlikely to take a back seat any time soon. Indeed, I recall a meeting with a school inspector during which we discussed the school’s progress data. I was able to illustrate and argue points using a range of statistical tools that are rarely found in an

Mastery of data analysis and statistics will give you a distinct advantage

Skills transfer Headteacher Mark Whalley learnt how to become a leader while working in research.
inspector’s tool kit. This helped my school through an inspection and did my career no harm at all.

Throughout my postgraduate career, I also honed my presentation skills. From my first talk at CERN during the first term of my PhD, through to lectures as a postdoc, I spent a lot of time planning and delivering talks to expert audiences both small and large. The ability to talk with confidence to a range of audiences is a key skill of school leaders. Whether you are addressing your science department, a whole body of staff or 300 parents, you need the confidence and experience to speak eloquently and convincingly. You are judged by this – you may well be the finest school manager, but fail in front of a critical audience and your credibility is out of the window. Allied to this is the ability to communicate complex ideas. Physics is complex and even with fellow physicists you will surely have to explain your own niche areas. Many issues in schools are extremely complex, made more so by the simple fact that they do not obey the laws of physics. So while you may not be explaining quantum field theory to a parent, I would say that explaining the latest guidance from the UK Department of Education on measuring progress to 100 parents comes a close second.

Having gone through some of the reasons that school leadership offers opportunities for physicists I should issue a caveat or two. Your teams will rarely contain others with backgrounds in physics, even if you are running a science department, so don’t be surprised if you are the only physicist in the room. We are trained in a unique discipline and we do tend to think in a particular way; do not expect your colleagues to think like you or necessarily even understand. Physicists have the potential to make great school leaders, but I wouldn’t like to see a school run by half a dozen of them! Your colleagues will be experienced, intelligent professionals, with equally valuable but potentially very different skill-sets to those you possess. It is this diversity – which is a strength and should always be encouraged – that makes school leadership teams work.

Every child, teacher, parent and community is unique, as is every situation; a consequence of which is that every leadership challenge is distinctive. Coupled to this is the fact that every school leader is unique when it comes to their own values, beliefs, experience, knowledge and expertise. Consequently there is no simple checklist to determine whether you could be a successful school leader, but for those pursuing postgraduate physics and looking for a meaningful career beyond universities and laboratories, school leadership may offer a rewarding future.

Mark Whalley is headteacher at Rookwood School in Hampshire, UK, e-mail dr_mark_whalley@outlook.com

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General Management Department
KEK, High Energy Accelerator Research Organization
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The Institute of High Energy Physics (IHEP) of the Chinese Academy of Sciences (CAS) invites applications for permanent staff positions at all levels. IHEP is a comprehensive research laboratory for particle and astroparticle physics, accelerator physics and technology, radiation technologies and applications, as well as for nuclear analytical techniques and interdisciplinary research.

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Recruitment Objectives:
Based on the needs of the research areas and the disciplines development of IHEP, we are now publicly recruiting overseas outstanding talents and scholars of relevant disciplines who possess research abilities and innovation awareness.

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1 National “Thousand Talents Program” (full time & part time programs) for established scientists.
2 National “Thousand Young Talents Program” for outstanding junior scientists.
3 Pioneer “Hundred Talents Program” of CAS, for outstanding junior scientists, excellent junior detector or accelerator experts.
4 “Outstanding Talents Program” of IHEP, for scientific research or technical talents.

Research Areas:
Experimental Particle and Nuclear Physics, Theoretical Physics, Astronomy and Astrophysics, Nuclear Technology, Multidisciplinary Research, Accelerators, Neutron physics, Condensed matter physics

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Applications should include a CV, an outline of academic accomplishments, description of current research and plan for future research, 3 – 5 published papers representative of your work, and a record of citations for your work. You should arrange for 3 letters of reference from experts in your field to be sent by post or email (established scientists are not requested).

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