Learning to teach physics
A guide to support from the IOP
We value and support all teachers of physics, whatever your background.

My early experience of science in school was not happy. I remember saying, “If this is science, then I don’t want to do it.” It was all facts and no explanations.

Then, when I was about 15, a wonderful young physics teacher joined and all my “whys” met answers. It was exhilarating. I became a polymer scientist and went on to lead a university department of engineering as well as working to influence science policy nationally.

Thank you Mrs Nancy Edwards!

But I am not alone – Mrs Edwards must have led dozens of girls into physics and science careers. So she also taught me how important it is to support new teachers because of the impact they will have on their students’ futures.

At the IOP we aim to make access to high-quality physics education open to all students in our schools. So whether you are a physics graduate or have another background, we offer you support as you teach physics, from your first teaching practice and throughout your entire school career.

This booklet describes some of the ways that we do this. We have materials to develop your own understanding of physics, teaching resources for lesson planning, advice on running practical demonstrations in the lab and many other online teaching tools.

You’ll also find out about our teacher support networks and online discussion forum.

With best wishes for your initial teacher education

Professor Dame Julia Higgins
President of the Institute of Physics
IOP early-career teachers programme

We offer FREE support to all student science teachers.

Welcome to the physics teaching community!

We want to help you teach physics whatever your specialism and whatever the level of the students you are teaching.

Sign up for our early-career teacher support and we will send you regular email updates with tips, teaching resources, career support and events specially created for student and early-career teachers of physics.

Register now at iop.org/student-teacher
Our bloggers

During the past few years, PGCE students have blogged for us during their training year. We asked them to be honest – and they were. Here are some excerpts from their early postings. You can follow this year’s bloggers at www.talkphysics.org/groups/talking-physics – look for the Student Teacher Blog posts.

“I am a few weeks into my science PGCE and it has been brilliant. The best thing so far is that it has reinvigorated my interest in science. I’m noticing science in action everywhere I go, giving me ideas for potential lessons and examples of science in the real world.”

“In our very first week we were set loose on a class of 16- and 17-year-olds. I still can’t believe that we survived the lesson, really enjoyed it, and most importantly, that some students actually learned something. That is probably the most important lesson I’ve learned in the first few weeks: it is not about you, but all about the students and their learning.”

“My one piece of advice for starting at your first school is to get stuck in straight away. I have helped in transition days for new year-7 pupils and open evenings at two different schools, attended child-protection courses and various CPD events. The first few weeks are the time to do all of this because when the teaching starts, I don’t think I will have as much free time.”

“I’d say the first few weeks of the PGCE have been quite overwhelming, but it has really helped to be with a group of people who are in the same boat.”

“I have been in school for four weeks now and I’m absolutely loving it. Some bits more than others, which is not surprising. Even after a hard day I still want to come back the following day – except if it is a weekend. Weekends are bliss!”

“One piece of advice that I got was to make friends with the technicians at the school. This has proved to be invaluable. The technicians have been extremely supportive, so far, of my ideas for experiments, dusting off old equipment and helping me rehearse experiments in advance.”

“A tip on job interviews from my secret advisor: make sure you have a back-up plan for any demonstrations and experiments you have booked equipment for, as some schools might want to test how you deal with unexpected equipment failure.”
Meet our team

We have drawn together some of the best and most experienced practitioners to create support networks for all teachers of physics.

Physics Network Co-ordinators (PNCs)

We have more than 50 PNCs throughout the UK and Ireland. They are very experienced teachers and former teachers who run free events and workshops for local teachers. You can also contact them for advice and support.

To find your local PNC, visit iop.org/network

Niloufar Wijetunge

PNC

I aim to build a network of teachers in my local area to promote dialogue and support them in teaching physics.

I’m particularly keen to ensure that we can inspire students to pursue physics post-16. Establishing strategies to tackle the shortage of girls in physics is also very important to me.

I’ve been teaching for more than 15 years (science up to GCSE, and physics and maths at A-level). I have run lots of science enrichment projects in schools, and in my spare time I’m a personal trainer.

Stimulating Physics Network (England only)

The SPN network has a range of supporters for local teachers, including Teaching and Learning Coaches (TLCs), School Based Physics Coaches (SPCs) and Gender Balance Officers (GBOs).

Visit stimulatingphysics.org/regional-events to find your local team.

Alessio Bernadelli

TLC

I have been mentoring early-career teachers and coaching teachers of physics from different backgrounds for more than four years.

I always look forward to meeting new teachers. In my region, I organise regular workshops to help early-career teachers develop best practice through both discussion and practical activities.

I am passionate about sharing ideas and networking with teachers from all sectors, through online support, face-to-face visits, or even just for a coffee to catch up and encourage them in difficult times.
IOP resources for teachers of physics

Finding new and engaging resources that you can trust is challenging. So we have created teaching materials that cover every level of physics teaching at secondary level.

Teaching physics presents unexpected challenges to both specialist and non-specialist teachers. The SPT materials have been developed for all new teachers of physics, boosting subject knowledge, highlighting common problem areas for pupils and offering teaching strategies. Explore SPT online at supportingphysicsteaching.net

TAP offers a comprehensive set of detailed resources to help you to plan lessons for 16–19 year olds. The resources are aimed at those who are new to teaching this age group, and don’t assume that you have lots of equipment or had advice from experienced colleagues. Adapt the resources to work for you. Download TAP (Word documents) at tap.iop.org

Physics practicals are a vital part of your students’ experiences at school. The Practical Physics website describes proven experiments in sufficient detail that they will work in any school laboratory. It also provides notes about teaching and learning, as well as health and safety issues. The site is ideal for teachers who wish to develop their practical craft in physics. Visit practicalphysics.org

All levels up to age 16
Secondary level post-16
All secondary levels
@TakeOnPhysics

Our Twitter feed is great for new teachers of physics. We use it to share ideas, events and resources: from the best physics apps to raising awareness of physics education policy issues and CPD events around the UK and Ireland.

Follow @TakeOnPhysics to build your own teacher network and connect with the wider physics community.

Classroom Physics

Look out for Classroom Physics in the schools that you visit. It’s the Institute’s termly magazine for teachers of physics.

It will keep you informed about the meetings, INSET courses, resources and support that the Institute and other organisations offer to all teachers of physics. It also includes some starter ideas, teaching tips and worksheets, particularly for 11–16-year-old students. You can find it online at iop.org/classroomphysics

Physics Teacher Network

Our network of more than 50 experienced physics teachers offers free CPD, support and advice to teachers of physics. Spanning the UK and Ireland, they run local workshops and build links with local schools. Visit iop.org/network

If you are in England or Wales, you may also be able to attend workshops run by the Stimulating Physics Network. Visit www.stimulatingphysics.org/regions-events
Why it’s good to TalkPhysics

You’re up late planning a lesson and suddenly realise that something you thought you understood now makes no sense whatsoever. Don’t worry – support is on hand 24/7 at TalkPhysics!

TalkPhysics is our online forum for anyone with an interest in school/college-level physics. With more than 10,000 members from physics teachers and teachers with other specialisms to lab technicians and teacher trainers, there is always someone who can answer your burning question.

Think of it as your digital physics prep-room. It is a place where you can get advice, share ideas, hear about CPD events, network and talk physics. Most of our content is safely secured behind a login, which means your conversations can’t be accessed by anyone (eg a student) who isn’t a member of the site.

- **Forums:** easy-to-join discussions with dedicated forums for news and teaching physics at 11–14, 14–16 and 16–19.
- **Groups:** you can join interest groups as well as set up private groups for confidential chats with colleagues.
- **Events calendar:** explore local and national events, workshops and CPD and book in online.

Join us at talkphysics.org
Here are some examples of ways early-career teachers have been using TalkPhysics:

**Tom soon discovered that he was the only A-level physics teacher at the school where he was doing his employment-based training.**

In addition, he found lots of equipment that he didn’t recognise and no usable scheme of work. TalkPhysics members rallied around, asking him to post photos so that they could identify kit, sharing their schemes of work and telling him how they’d survived similar experiences.

**Claire was being observed teaching a lesson on conductors and insulators to a mixed-ability class.**

She was looking for activities that would get the class moving around. Her request prompted 21 comments, many the same day, with suggestions for games, some video clips and practical ideas. It also stimulated a discussion on the pros and cons of different models and approaches.

**Allwyd had a job interview and had been asked to prepare an hour-long lesson on Newton’s first law and teach the first 20 minutes.**

As well as suggestions for activities and clips to use, TalkPhysics users gave him advice on how to structure a lesson; a warning that some schools block video-hosting sites; and an insight into what the interviewer would be looking for.
Help! I’m not a physicist

Never really liked or understood physics when you were at school? Dread the thought of having to teach it?

It’s OK. We know that there are plenty of science graduates starting their teacher-training courses who worry about physics. But don’t be afraid of teaching physics, even if it is not your main science specialism.

You can’t escape the fact that, whatever the subject, you need a good understanding to teach it effectively. But you’re a bright graduate who is teaching teenagers. With a little preparation, you will manage to keep a few pages in front of your class. Many trainees discover that they begin to enjoy physics when they start to get to terms with it and can see how all of the pieces of the jigsaw fit together.

In fact, your lack of specialist knowledge can give you an advantage. When you are new to a topic, you may be able to see the difficulties that students are likely to encounter much more clearly than the physics specialist, to whom the ideas have become second nature. To use the jargon, you may find it easier to “scaffold” the students’ learning or identify the steps needed to gain understanding. There is a real satisfaction to be gained from taking a conceptually demanding idea and teaching it well, especially if the idea was new to you a few days earlier.

Some trainee teachers are nervous about physics practical work and this makes them reluctant to use it in their teaching. Most students enjoy doing hands-on work and you need a variety of activities within a lesson to keep it interesting – any experienced teacher will tell you that visual aids are a vital part of their tool kit. Find out what other people do and try their ideas for yourself. The golden rule is to try out everything before the lesson to make sure that it works. Use www.practicalphysics.org for ideas and advice.

Don’t forget, it does your job prospects no harm at all if you can state on your CV that you are keen and able to teach physics.
Surviving teaching practice

As a student teacher, whatever your training route, you will spend the majority of your time in the classroom. Whether you are at the front leading a lesson or at the back observing, this is where you will really learn how to teach.

Make the most of opportunities to observe experienced teachers. It may seem strange advice, but ignore the science because you can learn a lot just from watching. How does he/she:

- engage the class?
- keep them interested?
- modulate his/her voice?
- control behaviour?
- handle transitions?
- emphasise important points?
- use body language?
- assess progress?
- manage materials?
- create a positive learning environment?

You should have the opportunity to observe all of the classes that you will eventually teach, so learn the students’ names and become familiar with their classroom routines.

At first, your timetable will be less than 50% of the workload of an NQT. As you gain experience and grow in confidence, you will gradually increase the number of classes that you teach until you will be teaching about 75% of the NQT workload. You should be teaching across the ability range, at both Key Stage 3 and Key Stage 4, and teach all three sciences at some level.

You’ll have plenty of support. In the schools you will have a subject mentor and a professional mentor. You will probably work closely with the class teachers as well. Your tutor will pop in a couple of times to give you feedback and advice. Don’t forget to make time to get to know your course mates or fellow trainees – remember that they’re going through the same experiences as you.

As the weeks in school progress, you will find that you experience a roller coaster of emotions. Sometimes you will feel that you are “probably the best teacher in the world”, while at other times you will wonder why you bother. The secret is not to get carried away with your successes and to take your failings on the chin, and bounce back smiling.
Become a member of the Institute

Join a vibrant community of people who share your passion for physics.

As an IOP member, you can be part of a community of professionals working together to support each other and promote physics in society.

- **Associate Member** – this category is for students, including undergraduates and apprentices, and for professionals with an interest or experience in physics but who might not have the experience or knowledge to allow them to apply for Member.

- **Member** – membership is for anyone with a degree in physics or a related subject, or who has equivalent experience and knowledge of physics gained in the workplace.

- **Fellow** – Fellowship is the highest level of membership attainable within the Institute and is for those with a degree in physics or related subject (or equivalent knowledge gained in the workplace) and who have made a significant impact on their sector.

**Membership benefits include:**

- discounted rates for IOP events and conferences
- professional development support throughout your career
- our monthly flagship magazine *Physics World*
- access to IOP journals
- a clear pathway to progress through each category of membership

Find out more at [iop.org/join](http://iop.org/join)

Find out about our strategy for success at [iop.org/strategy](http://iop.org/strategy)

The Institute of Physics is a leading scientific membership society working to advance physics for the benefit of all.

We have a worldwide membership from enthusiastic amateurs to those at the top of their fields in academia, business, education and government.

Our purpose is to gather, inspire, guide, represent and celebrate all who share a passion for physics and ensure that physics delivers on its exceptional potential to benefit society.

Alongside professional support for our members, we engage with policymakers and the public to increase awareness and understanding of the value of physics.

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