Physics and: its advantages

An Institute of Physics briefing note

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One of the IOP's fundamental aims is to increase the number of people who choose to study physics. Why?

From a national perspective, the answer is clear. Science and engineering are key to renewed economic growth, and to meeting the challenges of the 21st century, from sustainable energy and global security to lifelong health and wellbeing. To rise to these challenges we need to ensure that our education system is producing enough people with the right skills – and physics is an essential step in training for most science and engineering disciplines.

From an individual perspective, studying physics also offers real advantages. A-level or Higher physics is a valuable qualification for entry to a variety of courses at leading universities. A physics degree develops skills that open up an unrivalled range of career options, from manufacturing to the health services, and the computer games industry to the finance sector. And research shows that physics graduates can expect to earn more on average than the graduates of most other disciplines.

So the more people we can encourage to study physics, the better for us all. That's why, at IOP, we continue to campaign for more specialist physics teachers, and better careers advice for students.

Prof. Dame Jocelyn Bell Burnell,
Acting President, Institute of Physics

"We see science and math qualifications as reliable indicators of problem-solvers who can work in any area of the company."
Stephen Kennedy
Physics team leader, Havok

"Studying physics at school is excellent preparation for a range of challenging and rewarding degree courses."
Wendy Piatt
Director general, Russell Group

Physics opens many doors

Having some qualification in physics, whether at 16–19 level or for an undergraduate degree, brings a range of benefits to the student – both intellectually and in terms of career opportunities.

A report produced for the Institute in 2007 by Greg Rowland Semiotics describes physics as a "triumph of the enlightenment". It went on to add that while lay-people go about their lives understanding little of the world, physicists "have access to a greater understanding of the universe that everyone else merely occupies".

That understanding, and a more scientific way of thinking, are developed not only by degree-level qualifications but also by physics at A-level, or at Higher and Advanced Higher in Scotland.

At that 16–19 level, physics is also a "facilitating subject", considered suitable preparation for a wide range of degree courses precisely because of the way of thinking that it helps to inculcate.

"Subject choices at school or college can be crucial to maximising a young person's life chances," says Wendy Piatt, the director-general of the Russell Group of 20 of the UK's leading universities.

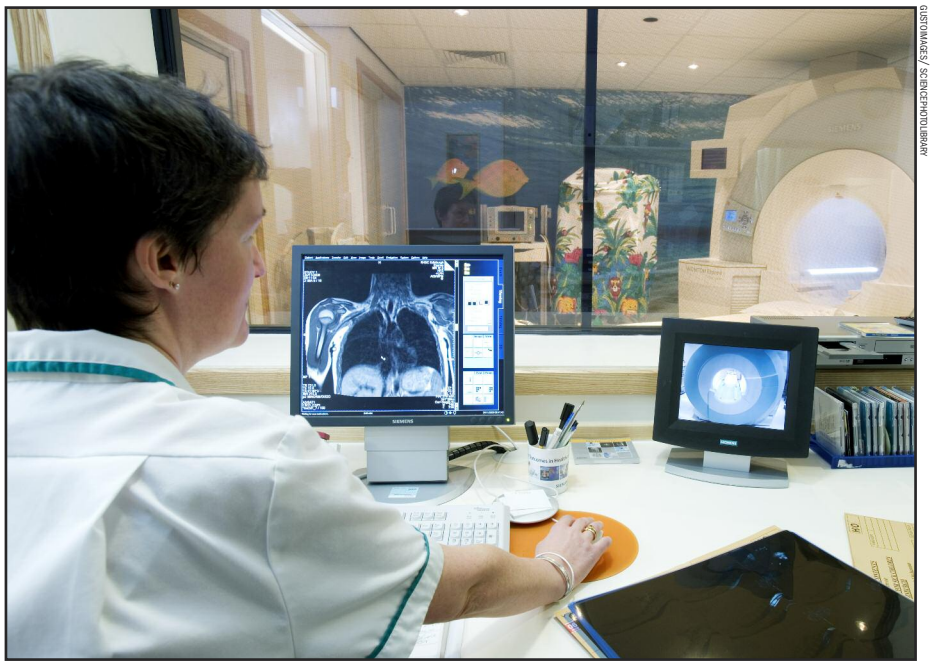
"Studying physics at school is excellent preparation for a range of challenging and rewarding degree courses and careers both inside and out of the sciences. This is why it is one of the 'facilitating subjects' most frequently cited as essential for entry onto both STEM and non-STEM courses at Russell Group universities."

Having the best system of school-level physics education that we can will mean that more people are better equipped to excel in the full spectrum of higher-education courses – or in a wide range of careers.

This is because physics does not only have value on its own terms or for its own sake, but the intellectual challenge of studying the subject translates into qualities highly sought-after by employers. So as well as being of individual benefit, having a strong physics education system and encouraging uptake of the subject helps to ensure that the UK workforce has skills the country's companies require.

Naturally enough, physics develops skills such as analytical and problem-solving ability, or the knack of grasping complex concepts quickly. But it also develops a wide range of "soft" skills vital to any modern workplace – learning to work in teams; communication skills; and making a >>>

Physics develops a range of transferable skills such as problem-solving ability



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Physicists in medicine might specialise in using diagnostic imaging tools such as MRI

Employers are finding it difficult to recruit people with scientific skills and are paying a premium for them

case to, for example, do a particular project.

Physics graduates can be found in virtually every sector of the economy. A longitudinal study of IOP members found that of those graduating from 2005–10 and going straight into work rather than into further study, 15% work in education, 7% in government, 28% in industry, 21% in services and 29% in other areas.

Of those in services, 42% were in the financial sector, where skills such as numeracy, analytic ability and problem-solving are particularly highly prized. Of those who participated in the Institute's survey, 58% said that their occupation was not particularly related or not at all related to physics, and yet 79% said that their physics background was quite useful or very useful.

With the proliferation of physics-based hospital equipment such as MRI scanners, radiotherapy and now proton therapy, physicists are increasingly found in a medical environment – in areas such as diagnostic imaging, nuclear medicine or therapies to treat diseases such as cancer using radiation or particle beams.

Dimitra Darambara, the team leader of multimodality molecular imaging in the Joint Department of Physics at the Institute of Cancer Research and Royal Marsden Hospital says: "As a medical physicist, I feel privileged to have a job that enables me to translate important findings in basic physics research from bench to bedside by developing and implementing innovative and advanced multimodal medical imaging techniques for the next generation of healthcare hardware with direct impact on the quality of life."

Because the skills developed by studying physics are so well-regarded by employers, people with a qualification in it tend to be better paid than those who do most other subjects.

This earnings premium may be a particularly important consideration with the coming increase in university tuition fees, as students increasingly see a degree as an investment for their future and want to extract the best value for money from it.

A degree in physics has been worth considerably above average for some time, and this is likely to be the case for the foreseeable future. The CBI recently stated that 43% of employers are finding it difficult to recruit workers with skills in science, engineering, maths and technology and are therefore paying a premium for them.

A report produced on behalf on the Institute and the Royal Society of Chemistry by the professional-services firm PricewaterhouseCoopers found that physics graduates earn 30% more over the course of their career than someone holding just A-levels. For the average graduate this figure was 23% above A-levels. For some subjects it was just 13–16%.

In Scotland, a survey of which the results were published at the end of 2009 found that more than half of those who had graduated in physics from Scottish institutions earned salaries of over £40 000, and 40% of them more than £50 000.

That figure rose to 50% for physics graduates who had completed their degrees before 1991. The differences in salary do tend to become more pronounced later in the career as the various benefits of a physics education become even more apparent.

Many physics graduates can be found working on the development of computer games, where they earn an average of £46 000 – more than any other type of graduate in that industry. Companies such as Havok, who provide software to the game and film industries, highly value people with aptitude for both physics and computing. "These individuals are rare," says their physics team leader Stephen Kennedy. "A key component of our products is not just abstract solving of mathematical problems, but innovation in choosing how to model the systems we're interested in. We see science and math qualifications as reliable indicators of problem-solvers who can work in any area of the company."

The individual value of studying physics naturally leads to benefits to the country as a whole. The report by PricewaterhouseCoopers mentioned above was initially compiled before the introduction of variable tuition fees in 2006, when the average degree cost around £21 000 to teach, but found that, although laboratory-based subjects such as physics are more expensive for universities, their graduates also provide more tax revenue – £135 000 over their working lifetimes, compared to an average of £93 000.

So although the initial investment in a physics student is higher, the return on investment more than pays this back even when only accounting for additional tax revenue – without taking into account the wealth-creation for which physicists are responsible, or technology such as life-saving MRI machines developed and operated by physicists.

The absolute number of people taking physics degrees has been increasing recently, but it has declined steeply as a proportion of the total number of undergraduates. The number of A-level entries is just beginning to rise again after a lengthy decline.

For both the individual and the economy, the case for encouraging more students to choose physics is clear. We know that key factors in students' subject choices are first and foremost the quality of classroom teaching, and the careers advice available. This is why the Institute of Physics continues to campaign for a specialist physics teacher in every school, and to work to ensure that careers advisers are knowledgeable about the opportunities opened up by studying physics.

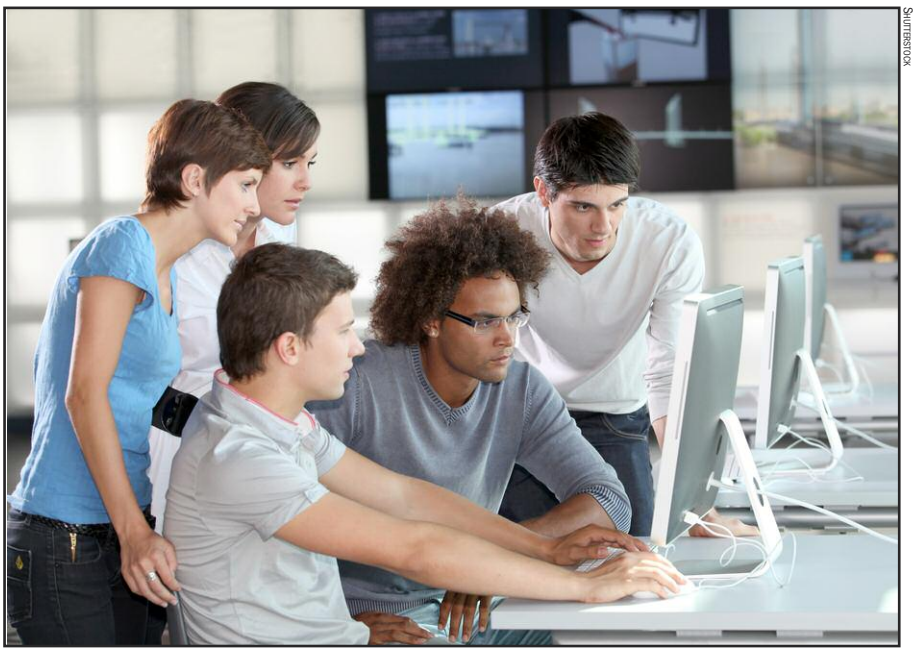
FURTHER READING

Institute of Physics reports

- *Physics on course: Physics courses in higher education* (2011)
- *Tracking the careers of UK physics students* (2010)
- *Physics in Scotland: the brightest minds go further* (2009)
- *Demand for STEM skills* (2008)
- *Semiotic Analysis and Development: Physics* (2007)
- *The Economic Benefits of Higher Education Qualifications* (2005)

Other organisations' reports:

- *Informed choices: A Russell Group guide to making decisions about post-16 education* (Russell Group, 2011)
- *Next Gen: Transforming the UK into the world's leading hub for the video games and visual effects industries* (Nesta, 2011)



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Physicists earn more than any other type of graduate in the computer games industry