

Teacher Fellowship Scheme

Promoting stronger links between schools and universities

May 2010



Contents

Preface	1
1: Aims and objectives	3
1.1 Objectives for the teacher fellows	3
1.2 Objectives for the university	3
1.3 Objectives for the supervisor	3
2: Implementing a Teacher Fellowship Scheme	5
2.1 Advertising and recruitment	5
2.2 Contracts	5
2.3 Post-appointment processes	5
2.4 Costs	6
2.5 Induction processes	6
2.6 Host-department management – the role of the supervisor	6
2.7 Full-time and part-time secondments	6
3: Case studies and key recommendations	7
3.1 Improving laboratory experiments and procedures	7
3.2 Improving overall pedagogy and teaching practices in departments	8
3.3 Suggestions for improving outreach activities	10
3.4 Suggestions for improving induction processes	11
3.5 Suggestions for improving the student experience	12
4: Appendix	13
4.1 Checklist for running a Teacher Fellowship Scheme	13
4.2 Template for teacher fellow reports	13
Acknowledgements	15

Preface

The Institute of Physics (the Institute) was pleased to be able to offer the Teacher Fellowship Scheme to 10 university physics departments through the Higher Education Funding Council (HEFCE)-funded Stimulating Physics Programme, which ran from May 2006 to July 2009. The core aims of the programme were to find ways to increase the numbers of students taking physics at A-level and progressing onto a degree in physics.

The Teacher Fellowship Scheme was a key initiative in the programme – the aim was to forge and foster stronger links between schools and university physics departments, with a view to forming a partnership with the school and local university. Physics teachers from schools and further-education (FE) colleges were seconded to their local university physics department and embarked on a series of initiatives aimed at easing the transition between school and university physics.

The scheme was extremely popular, and was beneficial to the 12 teacher fellows who took part in the secondments and the 10 host university physics departments. The secondments were seen as an important piece of career development for the teachers. It allowed them to see how physics is being taught at university level and also enabled universities to understand more about students' capabilities because the fellows could offer advice on how to improve the pedagogy of the physics course. It also provided the opportunity to improve the quality of outreach activities.

This report aims to give an overview of how a university department can implement its own Teacher Fellowship Scheme, and to distill key recommendations on how departments can improve their teaching, learning and outreach activities. We hope that by embedding the good practice and key recommendations into departmental practices, this will be the lasting legacy of the project.

Dr Saher Ahmed, Institute of Physics, May 2010

1: Aims and objectives



Objectives and guidance for the teacher fellows and departments

The Institute's Teacher Fellowship Scheme seconded physics teachers working in schools and FE colleges into their local university physics departments to work on a range of objectives concerned with the progression from school to university physics. The aim of the scheme was to form mutually beneficial partnerships between teachers, local schools and university physics departments. In the original scheme, 12 teachers were given the opportunity to work within 10 physics departments.

There are many models that could work successfully and effectively, however, the advice and guidance given in this document is based on the Institute's scheme.

1.1 Objectives for the teacher fellows

- To gain an insight into current undergraduate teaching practices in physics, by assisting with the teaching of introductory or year-one courses, laboratory practical classes, seminars or tutorials.
- To enrich school or FE physics teaching by using insights gained from the time spent with the university and utilising the facilities available within the host department.
- To broaden students' horizons beyond school-level physics, by bringing concrete examples of physics and its applications experienced first-hand during the time spent within the university.
- To advise and assist the physics department on its recruitment and widening participation strategies.
- To advise the university on A-level curricula.
- To advise on adapting the university's existing curriculum and teaching practices to improve retention rates.
- To provide better informed advice to school students on university application processes.
- To write an interim and final report on the experience of the fellowship scheme, for circulation to the university, school and other stakeholders.

1.2 Objectives for the university

- To better understand the aspirations and motivations of school students.
- To potentially improve the retention rate of the undergraduate students.
- To better understand the various school curricula and recent changes made to A-level syllabi, and the capabilities of the incoming students.
- To develop sustainable links with local schools.
- To take lectures and demonstrations to the fellows' schools or FE colleges.
- To better understand how to organise visits of school students to physics departments.

1: Aims and objectives

1.3 Objectives for the supervisor

- To provide induction for the fellow at the commencement of the secondment, and ongoing assistance and mentoring as reasonably required by the fellow throughout their fellowship.
- To provide the infrastructure to enable the fellow to fulfill their duties effectively and efficiently (including providing fellows with adequate desk or office space, use of a computer, access to e-mail, intranet, internet and telephone).
- To supervise the fellow on a weekly basis.
- To discuss and agree with the fellow the work to be carried out during the course of the secondment.
- To provide an interim and final supervisor's report.

There is scope to alter and amend these objectives and guidelines; however, it is important to be clear about what the objectives are and what you are trying to achieve.

2: Implementing a Teacher Fellowship Scheme



2.1 Advertising and recruitment

The timing for recruitment is of paramount importance. Advertising at the beginning of the school year for fellows to start in the following academic year allows appropriate replacement teachers to be found.

Placing adverts in the *Guardian* jobs section and *The Times Educational Supplement* elicited good responses. However, advertising the fellowships in a more systematic manner via a targeted mailing to all secondary schools in England proved very effective, with more than 50 enquiries. If the scheme that you are intending to run has a regional or local focus, it may be more appropriate to utilise local networks.

Before commencing with the recruitment process, it is essential to obtain the approval from the fellows' schools. For example, the Institute asked for a letter of agreement from the head teacher as part of the application process.

2.2 Contracts

It is recommended that the teacher fellows remain within the employment of their schools or FE colleges and the fellowships are defined as secondments.

In the Institute's scheme, the teachers were paid their normal salary within the school system and associated on-costs, such as national insurance and pension contributions, and the programme reimbursed the school for the days that the teachers were on the secondment, with the cost being used by the school to pay for a replacement teacher to cover the fellows' workload. Letters of agreement (in place of a contract) were drawn up for the teacher fellows, their schools and the host university departments. This outlined what was expected of them during the course of the fellowship, as well as detailing the host university departments' obligations.

2.3 Post-appointment processes

Once a fellow was appointed, permission from the school was obtained to allow the fellow to undertake the secondment. To minimise the impact, it was suggested to the schools that fellows on a part-time secondment should have the timetable adapted in order for them to take A-level and GCSE classes on the days that they were at the school and allow the replacement teacher (often a non-physics specialist) to cover year 7–9 classes. This meant that it was not necessary to find a replacement specialist physics teacher. If the teacher fellow was on a full-time secondment, the school often found it easier to recruit a physics specialist. Some schools used retired physics teachers to cover A-level classes and the Institute helped to find suitable replacement teachers via its teacher networks.

2: Implementing a Teacher Fellowship Scheme

2.4 Costs

For the scheme to run successfully, adequate resource is essential. If full-time fellowships were offered at every department in the UK, this would cost £2.5 m per year. However, there are enormous benefits that can be gained from a relatively small investment, and a more sustainable model would be if every physics department funded a teacher fellow for a term every couple of years, or even on a two-day-a-week basis for a year.

The amount that the Institute had to pay for the teacher fellows was dependent on how much the teacher earned within their own schools. The Institute also paid each host department some money to cover costs such as office space and IT equipment.

2.5 Induction processes

Fellows were inducted at their host university, with the process being the same as the induction of a new member of academic staff.

We asked that the fellows should be provided with office space, a telephone, entry on the staff directory and an e-mail address, and introduced to all members of the department and other key members of staff in the HEI. In your own scheme, we would recommend that fellows meet with:

- the head of department;
- the department's admissions tutor;
- the head of year-one teaching and the head of laboratories;
- all physics senior lecturers and lecturing staff;
- widening participation staff and staff involved in student recruitment;
- student course representatives;
- the admissions department;
- the head of physics teaching;
- all other members of the physics department.

2.6 Host department management – the role of the supervisor

The Institute stipulated that a nominated member of the senior academic team in the host department should have responsibility for the fellow. The role of the supervisor is to meet with the fellow regularly to provide support, advice and guidance during the course of the secondment; monitor progress and help the fellow to develop new areas of work as necessary.

Supervisors should introduce the fellow to all members of the department, and it is recommended that all fellows attend departmental meetings to enable them to feel part of the department and to be kept informed of departmental matters. It also helps the fellow to feel more comfortable if there is a means of interacting socially with other members of staff, for example, in the department coffee room.

We also asked supervisors to write an interim and final report on the progress of the fellow, and to provide feedback to the fellow at the end of the secondment.

2.7 Full-time and part-time secondments

We found that there were advantages and disadvantages associated with part-time and full-time secondments. In the pilot scheme, the Institute tried to be as flexible as possible and the fellows' secondments varied from part-time arrangements, such as one day a week or full-time for a term, to full-time one-year secondments. Feedback from some of the Institute's fellows suggested that it was useful to be seconded on a part-time basis because it allowed them to immediately put into practice learning outcomes at their school. It also allowed them to keep up to date with what was happening within their schools. However, other fellows reported that from the schools' perspective, full-time secondments were more practical because finding appropriate cover on a full-time basis is easier to achieve. Full-time fellows also reported they were better placed to be "absorbed" into the university culture and to feel fully part of the team and department.

3: Case studies and key recommendations



The experiences, recommendations and suggestions outlined in this section are based on the experiences and good practice obtained by the Institute's teacher fellows.

3.1 Improving laboratory experiments and procedures

“I helped to develop online pre-laboratory activities to allow students to relate their lecture work to practical sessions. We ensured that laboratory manuals are clear; the notation is familiar and the language is appropriate. We tried not to place unrealistic expectations on students – for example, we made sure that concepts have already been covered in the A-level curricular or have been covered, or are being covered, in lectures.”

Key recommendations

- Offer small group plenary sessions for laboratory work to aid learning and understanding.
- When demonstrating in laboratory sessions, circulate among students, assisting where necessary and probe students' knowledge and understanding.
- Provide training to demonstrators on how to provide effective feedback.
- Rewrite laboratory manuals for year-one experiments to be adapted for foundation-year students or year-12 students attending masterclasses.

“The fellows' activities in the first-year laboratory classes have highlighted an unforeseen mismatch in the practical skills of the first-year students and sixth-formers. Colin's findings, via questionnaires and observations of lab teaching, have fed into discussions of a pre-lab activity, which has been subsequently trialled and found to be useful to first-year students. Roll-out to follow in future years.”

Dr Sean Freeman, supervisor to Colin Davidson (2006–2007) at the University of Manchester

3: Case studies and key recommendations

Example: running effective workshops or problem classes

Whenever possible, problem classes should be held in a classroom-style room, rather than a lecture theatre. Ideally the questions should be distributed to the students a few days before the class takes place so that the students have a chance to attempt the questions before the workshop.

- Push tables together to facilitate and encourage group working. This arrangement also means that it is easier to talk to several students at the same time and the students are much more likely to ask further questions.
- Ensure that demonstrators are proactive and ask the students

probing questions. There should be enough demonstrators to ensure that all of the students get the assistance that they need.

- When a student asks for help in solving a problem, try and encourage them to work it through for themselves. Ask questions to understand at what point in the problem their understanding lets them down, then try asking questions that move them onto identifying the next steps in the problem.
- While a few simple questions at the start of the session to engage the students can be effective, try to limit

these. Students want help with the difficult problems and are frustrated if a class ends and they still cannot solve the more complex questions. It is better for the students to leave feeling that they have learned something or developed a skill during the session.

- Always be encouraging when a student asks a question. If they do not understand the first attempt at an explanation, then try and take a fresh approach or go further back in their knowledge to check that they understand the more basic concepts. Always be positive and encouraging.

3.2 Improving overall pedagogy and teaching practices in departments

“I used ‘TurningPoint’ clickers in lectures to engage students. Many students are cautious of raising their hands in lectures and won’t respond to open questions, and this proved to be an effective way to engage with them.”

Key recommendations

- When introducing yourself to the students, briefly describe the research that you are involved in as this reinforces to the students that you are a research scientist and more than just their teacher. It also introduces them to the different types of research that are carried out in the department.
- Invite questions and try to be encouraging when students ask simple questions, as they have probably taken a long time to pluck up the courage to raise their hand.

“I used animation and videos in my lectures, and tried to ask the students open-ended questions to allow discussion.”

“We looked at the appropriateness, density of material presented, pace of the course and the demands placed on the students. We identified a mismatch between the students’ knowledge and the requirements of the first-year course, so I worked with the curriculum development teams to incorporate changes made to A-level maths and physics curricula into the first-year course.”

Key recommendations

- Develop a culture of coaching or mentoring of first-year students by final-year students.
- Have a dedicated “teaching and learning co-ordinator” or “associate professor for teaching and learning” (using “natural” teachers from the host department), who are responsible for improving the pedagogy in physics departments via the development of a teaching best-practice culture.
- Ensure that there is an intervention process in place to catch “falling stars” that have the aptitude to continue with the subject but drop out.

3: Case studies and key recommendations

Example: running an effective 1 hr lecture

- Starter activity (5–10 min): share the learning objectives, review the last lecture, have a warm-up Q&A session or problem-based activity.
- Main activity (40–45 min): intersperse the main body of content with testing for knowledge (quick problems or questions, using clickers, if possible).
- Plenary activity (5–10 min): review the work covered, conduct an analysis of whether the learning outcomes were achieved and recommend reading for the next lecture.

Key recommendations

- Facilitate a forum for students so that they are able to meet and discuss teaching and learning issues away from academics. This (anonymous) information can then be used constructively by academic staff to formulate practice.
- Wherever possible, ensure that the laboratory programme matches the lecture programme content to avoid experiments being undertaken before the student has encountered the subject in a lecture.
- The use of maths in physics at degree level is not necessarily intuitive to students. Ensure that any maths lectures taught in the course demonstrate the direct relevance in physics.

“David’s primary contribution to a ‘changed way of life’ in the department has been to bring our attention to differences in the actual experiences of school-aged students and our perceptions of the same. There has been a knock-on effect in the way that we interact with our level-one students. Small changes in technical vocabulary, in what we deemed would excite students, in our choice of demonstrations shown and the associated descriptions. all have significant impact. These changes are manifest in a completely revamped UCAS day, in a new ‘wind power’ competition for schools, in reworked and more accessible level-one laboratory scripts, and in updated marketing materials.”

Prof. Peter McDonald, supervisor to David Hemsley (2007–2008) at the University of Surrey



3: Case studies and key recommendations



3.3 Suggestions for improving outreach activities

“I produced a series of posters and worksheets to introduce and guide the students through a broad range of stimulating activities while they were waiting to be interviewed.”

Key recommendations

- Ensure that there are separate parent-centred activities during open-days, along with activities aimed at the potential students, or run parallel programmes for these groups of visitors.
- Highlight the careers potential of physics during open days and fully address the myth that degrees in physics can only lead to teaching or research.
- Fully brief staff and ambassadors prior to open days – open days are crucial marketing exercises and can make all the difference to how potential students view the department.
- Utilise alumni networks. For example, set up an alumni network of undergraduates that are prepared to visit their old schools to give talks to increase recruitment, or write to the schools of those students who have recently graduated with a first or 2:1 to inform the school of this good news and to encourage more students from the school to apply for places at the university.
- Encourage school or FE students to carry out coursework projects at the university.
- Develop and embed events for school teachers and produce a portfolio of outreach activities for pre-application students.
- Develop masterclasses for pre-applicants or potential students.
- Develop revision classes for both potential and first-year undergraduate students.

“I helped to facilitate work experience for students: I worked with Schools Liaison and Trident (from Edexcel); identified and recruited eight work-experience students; liaised between the students, schools and Trident to finalise arrangements and supervised and reported on the students during their experience.”

3: Case studies and key recommendations

“I developed a series of activities for the schools physics competition where students built and tested a wind turbine and AC generator. Eighteen schools entered in teams of six students, who wired their generator, designed and fabricated their turbine blades, then optimised their design to achieve the highest electrical power output and turbine speed. They also competed against other schools in a written quiz and power-output and turbine-speed competition. The apparatus was designed to use components that were easily purchased through schools suppliers, were mechanically simple and robust, but conceptually demanding enough for students to apply GCSE-level physics to solve an engineering problem.”

“As a result of the fellowship, teaching staff are now much better informed of the aspirations and motivations of incoming students. Philip has helped to make lectures more interactive and made staff think more about our outreach activities and tailoring visits to meet the needs of the schools.”

Dr Robert Jones, supervisor to Philip Furneaux (2008–2009) at the University of Lancaster

3.4 Suggestions for improving induction processes

Key recommendations

- Implement a “buddy” system for first-year students, whereby they are paired up with an existing undergraduate physics student.
- Ensure that new students receive a full tour of the department during the first week and introduce the students to the academic team.
- Provide as much information as possible prior to induction week, so that students feel more informed on their first day.
- Arrange ice-breaker activities with the first-year students.
- Arrange tours or lectures in the department for local school or college physics students.
- Encourage the use of Institute teacher networks and network co-ordinators.



3: Case studies and key recommendations

Case study

“My entry to physics teaching in my early forties was, perhaps, somewhat different to many teachers in that I have had experience as a postdoctoral research scientist in a government research establishment as well as industrial experience in technical marketing and sales. My step back into a university environment as an Institute teacher fellow was therefore most welcome, especially after spending several years repetitively regurgitating GCSE and GCE syllabuses.

“When I arrived at work on my two days each week at the university the first thing I did was to spend a few

minutes listening to the almost silent hum of the air-conditioning system; there was no other sound; perhaps you need to be a teacher to appreciate this delight.

“The work for the Institute drew on all aspects of my previous experience. I was able to quickly assimilate into the new organisation and use my knowledge of physics, marketing and teaching methods to improve the university’s communications with aspiring school leavers. It was nice to be able to put my ideas into practice during UCAS days and school visits to the university. Seeing school kids from this perspective makes the blood,

sweat and tears of teaching seem even more worthwhile.

“The motivation gained from this therefore went well beyond the teacher fellowship experience itself because, after returning to the classroom, you are reminded of the wonderful opportunities that good teaching creates for the young people in your care. I rediscovered how intellectually stimulating it was to work with academics and it was so good to be able to spend enough time on tasks to complete them to a standard that gave personal satisfaction. This is a twin-edge sword, of course, because soon you’re back at school!”

3.5 Suggestions for improving the student experience

“The best part of teaching used to be the holidays, but now it’s being an Institute teacher fellow.”

Key recommendations

- Survey the physics students to elicit feedback and opinion on the way that the course is run and how it can be improved.
- Encourage and facilitate student focus groups to elicit students’ opinions on teaching and learning and suggestions on areas for improvement.

“Ralph’s stay with us was simply amazing – it was the best initiative in enhancing the students’ academic experience, in my memory.”

Prof. Brian Cowan, supervisor to Ralph Fleming (2007–2008) at Royal Holloway, University of London

4: Appendix

4.1 Checklist for running a Teacher Fellowship Scheme

- Advertising and recruitment – timing is paramount. The selection criteria used in the Institute’s scheme are detailed below. Ensure that what you are asking for is appropriate and realistic.
- Contracts – draw up letters of agreement for the teacher fellows, their schools and the host university, detailing the teacher fellows and the university’s responsibilities.
- Induction processes
 - ensure that the teacher fellows are given a full induction at the host university and within the department;
 - ensure that the teacher fellows are provided with office space, a telephone, entry on the staff directory and an e-mail address.
- Supervision – introduce the fellow to members of the department.

Selection criteria for the teacher fellows

The successful candidate will need to:

- ✓ be teaching physics currently in a school or college. Applicants should preferably have had at least three years in their current post
- ✓ have excellent interpersonal skills, to include:
 - an ability to work autonomously and flexibly, and
 - an ability to negotiate and deal tactfully with teachers and others
- ✓ demonstrate good communication skills, oral, written and IT
- ✓ possess organisational skills, including an ability to identify and anticipate problems.

4.2 Template for teacher fellow reports

Insights

- What insights into university teaching practice have you gained so far?
- Have you been able to undertake some teaching?
- What changes has the department made and how have they become more aware of the needs of their current or incoming students?

Links

- What links have you made within and outside of the host department?
- Have you been able to “bridge the gap” between your school and the university?

Student recruitment

- How have you advised and assisted the department on recruitment issues and widening participation?
- In what ways has this been achieved?
- What are the (positive) outcomes from your interventions?

Retention rate and pedagogy

- Have you advised the department on the way that it teaches students and the content of the curriculum?
- Has the retention rate improved in the department, if so why?

Admissions

- What insights have you obtained into the admissions process?

Any other work

- Please use this section to detail any other work that you’ve done that does not fall into the categories above.

Plans for the rest of the secondment

- What will you focus on for the remainder of your secondment?

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Teacher fellows

2006–2007

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David Hayton, King Henry VIII School, Coventry

Trevor Plant, Portsmouth College

Francisca Wheeler, St Clements Danes School, Hertfordshire

2007–2008

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