



## UNIVERSITY TEACHERS' VIEWS ON THE PRACTICAL SKILLS OF SCIENCE UNDERGRADUATES

Results of research undertaken by Laura Grant Associates for the Gatsby Charitable Foundation, 2011

### Summary

In April 2011, key science staff in Russell Group universities were surveyed about the standard of new undergraduates' laboratory skills. The results suggest that A levels are not adequately preparing even the brightest students for science courses in our top universities and that this could compromise the quality of science undergraduate degrees. In September 2011, 45 higher education staff from the bioscience, chemistry and physics departments of 25 UK universities took part in research workshops exploring the practical skills needed by new science undergraduates. Participants agreed a core set of practical skills, as well as those specific to their disciplines, that should be considered when science A levels come under review in order to improve progression to university.

- All survey respondents felt that students arriving onto undergraduate courses lacked confidence in the lab and 97% felt that new undergraduates are not well-equipped with the necessary lab skills.
- 57% of respondents felt that the level of lab skills in new undergraduates had declined in the last five years (compared to 29% and 37% reporting a decline in levels of knowledge and understanding respectively), despite the grades required for entry to courses having increased.
- Universities have been forced to adapt their courses because of the decline in practical skills, with an inevitable impact on the depth of students' learning during their undergraduate degrees.
- HE staff lack information regarding the practical work undertaken in schools and colleges and have a strong appetite for better links with those creating and teaching science A levels.

### Key Findings

HE staff report that new undergraduates do not arrive at university with the necessary confidence or laboratory skills to succeed on undergraduate courses.

- *No respondent felt that new undergraduates are confident in the laboratory, while 13% of respondents said students were completely lacking in confidence.*
- *Only 3% of respondents said new undergraduates are well-equipped with the necessary lab skills, while half said students come poorly-equipped.*

Most respondents perceive the level of new undergraduates' lab skills to have fallen over the past five years. In contrast, the majority feel new students' levels of understanding and knowledge has stayed the same.

- *57% of respondents felt the level of lab skills had fallen, compared with 29% who felt the level of knowledge had fallen, and 37% who felt the level of understanding had fallen.*
- *This despite all respondents saying they had increased entry grades required for courses.*

The decline in practical skills has reached a point where HE staff believe it is an issue which in many cases is having a significant impact on undergraduate education.

- *Many participants said that they assume their new undergraduates will come in with limited or no practical skills.*

- *University teaching staff reported needing to make changes to their lab-based teaching, including: simplifying first year lab courses; introducing online pre-labs; and increasing support to students through more staff time and demonstrators.*
- *While most felt that the issue was one they could cope with at the moment, they also said that they were now increasingly dedicating time to teaching skills that new undergraduates had previously arrived with.*

Undergraduate teachers feel that students' lack of laboratory confidence and declining skills are linked to their limited experience with 'hands-on' science practical work at school.

- *HE staff said feedback from their students suggested schools were covering less practical work prior to university, with some students claiming that they had done no practical work at A level.*
- *Even when students reported experience of hands-on work at school, they tended to have a very limited set of skills relevant to undergraduate experiments and were overly mark-orientated.*
- *However, participants noted that students who had completed an extended investigation as part of their A level appeared better equipped for university practical work.*

There is agreement across the disciplines on the most important practical skills needed by new undergraduates to succeed, and also agreement that these are the skills in decline.

- *Workshop participants identified the following practical skills as most important for first year undergraduates' success: confidence and a positive attitude; independent thinking; and the appreciation and application of scientific methods and practice (particularly report writing).*
- *Across biology, chemistry and physics, skills deficits were reported in a number of areas, including technical ability, making and recording observations, and the use of particular equipment.*

Undergraduate teachers do not feel well-informed about practical work in schools and have to rely on their students as their main source of information as to what is going on in pre-university education.

- *HE staff expressed frustration that they did not fully understand what they could expect of their new undergraduates with regards to practical skills and that there was no formal channel to find out about the practical work taking place in schools.*
- *There was a widespread view that universities' relationships with exam boards and schools needed to be strengthened to better inform decisions about course content.*

## About the study

Gatsby is a foundation set up by David Sainsbury to realise his charitable objectives. Gatsby has been supporting Science, Technology, Engineering and Mathematics (STEM) education in the UK for more than 25 years. In 2011, Gatsby began work to build an accurate picture of the health of practical work in secondary school science in order to understand how best to support it in the future.

In April 2011, an electronic survey was developed and distributed directly to 75 potential respondents from admissions tutors and those involved in first year lab teaching in biological science, chemistry and physics departments in Russell Group universities in England. Thirty-four respondents completed the survey, and 12 went on to participate in a follow-up interview. In September 2011, four one-day workshops were held in Manchester, Bristol and London. Forty-five higher education staff from the bioscience, chemistry and physics departments of 25 UK universities participated in structured discussions at the workshops.

For more information about this study and Gatsby's Practical Work in School Science programme, please see our website: <http://www.gatsby.org.uk/Education/Projects/Review-of-Practical-Science-in-Schools.aspx>