How technicians can lead science improvements in any school: a small-scale study in England

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ABSTRACT This article describes how seven schools in England improved their science provision by focusing on the professional development of their science technicians. In September 2013, the Gatsby Charitable Foundation funded the National Science Learning Centre to lead a project connecting secondary schools with experienced senior science technicians (technician advisers) to design and implement action plans aimed at improving their technical service. Schools could claim up to £2,000 but it was the input of an external mentor that had the most striking impact. The outcomes were seen directly in the classroom, with teachers having more confidence and students having a more varied and high-quality practical experience. It is suggested that, for schools seeking improvements in their science provision, modest investment in the professional development of their science technicians can yield significant benefits.

Background

Practical work is an essential component of science education in the UK for the many benefits it can bring to the teaching and learning of science. Both employers (Gatsby Charitable Foundation, 2012) and universities (Grant and Jenkins, 2011) have stated that practical skills are of high importance and that practical work remains at the centre of science qualifications. School science technicians carry out a range of tasks to support practical work, including:

- the preparation of experiments and maintenance of equipment;
- overseeing the health and safety of the science department;
- ensuring that teachers have considered the risks associated with practical work;
- storing equipment and consumables appropriately.

Experienced technicians may also control budgets, make purchasing decisions and go into the classroom to support practical work directly with students (Moor *et al*., 2006).

In many schools, not only is this support recognised, it is considered critical to the quality of science teaching and learning, affording technicians both status and resources. But the case is different in other schools where budgets are stretched, resulting in considerable variation in the funding allocated to support practical work across schools (SCORE, 2013). Poor facilities and a lack of efficient systems can make the job of a technician unnecessarily difficult. At the same time, technicians often have the most extensive knowledge of practical work in a science department but this is often under-exploited. It is therefore important to signal to senior leaders and those in control of school budgets not only the implications of reducing their technical support but also the potential gains from investing in it.

In order to explore the most effective forms of investment in technician development, and evidence the impacts it can have, the Gatsby Charitable Foundation funded the National Science Learning Centre (NSLC) to work with seven schools to chart the effects on their science departments of empowering their science technicians.

Methodology

To ensure the lessons learned from this work could be applied as widely as possible, the

schools approached to take part were selected by the NSLC to constitute a range in terms of (Ofsted) performance, geographical region, numbers of pupils, key stages taught and number of technicians. A memorandum of understanding was signed at the outset by the science department and head teacher in each school. The involvement of senior leaders at the start of the project helped to ensure that technician-led development was a whole-school priority.

Schools were provided with up to two days' support from a technician adviser (an experienced senior technician from a local school). The technician advisers were selected from alumni from the Senior Technicians Accredited Co-leaders in Science (STACS) course who had been awarded a University Certificate in Science Education and Leadership (Science Technician) from the University of York. They also undertook an additional day of training in coaching and mentoring in preparation for working with schools in this project. Each of the advisers had approval from their school and used the project as an opportunity to further their own professional development.

Following their initial visit from a technician adviser, technicians in project schools created action plans for improvement. A £2,000 development fund was also available to each school to support their activities, subject to approval from their adviser in order to ensure spending remained focused on the development of the technical service and not more broadly on the science department or school. The technician advisers did not dictate activities to departments but helped schools identify areas where they could improve (Figure 1). Schools had a relatively short window of five months to make subsequent changes to their department and capture impacts.

Feedback throughout the process was provided by the technicians, heads of science, head teachers and the technician advisers; this ensured that the impact of the project on individual technicians, the science department and the whole school was captured.

Resource allocation and its impacts

Finding the time to undertake any development activity is notoriously difficult within a busy school. One school tackled this by organising a day where no requisitions were to be submitted to the technician team. Small investments of time can have significant impact on a department, with one senior leadership team exclaiming that a day of external support had achieved more in one day than they had being trying to do in the past four years.

Figure 1 Technician Paula Rowe (Enfield Grammar School) discussing development ideas with technician adviser Paul Cook (Burlington Danes Academy)

It sometimes seems hard to find the time to work on improvements when we are struggling to keep up with the basics, but it has definitely been worth putting in the extra effort in the short term to achieve the long-term goals. (Technician)

Funding was used by the schools in a range of ways, depending on their needs and the action plans. Six of the seven project schools used nearly all the funding available, with the largest percentage going to develop more effective and efficient prep room and storage areas and improving requisition and inventory systems. This is perhaps unsurprising given that a SCORE (2013) report on the resourcing of practical work at secondary level found that across the country '*prep rooms are often too small, with inadequate storage and preparation space*'. The second highest expenditure, across five schools, was on continuing professional development (CPD) activities, for fee-paying courses and, in one case, additional paid hours to attend.

Prep room and storage

Six of the departments involved in this project incorporated activity relating to the improvement of their storage, workspaces and equipment organisation into their development plan. In one school they supplemented the NSLC fund with their own funds in order to adapt a

storage room to be a new prep room, but in the remaining schools reorganising existing spaces and purchasing additional shelving, trays and trolleys was sufficient. In smaller technician teams (in one case a lone technician) the teaching staff were involved in this process and additional space was made in the laboratories to house regularly used equipment. Being given the space and time to reorganise a stock room and to implement advice about storage and layout from CLEAPSS (2005; 2009) and the Association for Science Education (ASE) can have significant impact:

[organising the department] *should help elevate us from been a school prep room to a professional technical department.* (Technician)

A well-ordered prep room increased the efficiency of all the science. The ability to find equipment quickly freed up technicians to spend time developing new practicals or to support demonstrations in the classroom. It also helped new technicians become proficient at supporting practicals more rapidly, enabled technicians to cover the workload of absent colleagues and allowed teachers to find pieces of equipment if technicians were busy. Two schools implemented a system of trays containing common practicals that teachers could access independently, freeing up time for technicians to focus on more complex work.

Several departments took the opportunity to rationalise their equipment. Others discovered 'new' equipment hidden in prep rooms and used their technician advisers to identify and understand how to use unknown pieces of kit. Irreparable, old or unwanted equipment was thrown away or recycled. One school donated surplus kit to LabAid, a charity that provides unwanted lab equipment to schools in developing countries across the world (www.labaid.org).

Several heads of department commented on how a well-organised prep room indicated to the department, and wider school, that the science technicians were part of a professional service. Technicians themselves reported improved morale due to the positive working conditions they created. Teachers were also impressed, and in one school it was noted that staff were more confident in requesting practicals and certain pieces of equipment that they had previously not felt it was possible to ask for.

Improving systems

Linked to the work undertaken to improve the physical space in the prep room, several schools spent time improving their processes and systems. Equipment inventories were created by several schools, including the introduction of barcoding to speed up stock checking. Knowing what equipment is in stock, and knowing when new equipment and consumables need to be ordered, is critical for supporting practical work and also for ensuring good budget planning and value for money.

Several schools introduced or updated their requisition systems – the process by which teachers order equipment and materials for their upcoming practicals. Those schools that implemented a requisition system for the first time were better able to plan their weekly workload across the whole technician team. One school also introduced a whiteboard where the weekly plan was posted. This made teachers aware of which equipment was likely to be available for their lessons without having to ask the technicians directly.

By putting these systems onto a school intranet, some schools began to link equipment for specific practicals to schemes of work and 'how to' guides. Heads of department commented that this enabled teachers to build their confidence in doing different practicals. This was particularly helpful for new teachers, those working outside their specialism or staff covering absence.

Professional development

To move a technical team forward it is important to invest in staff development. At the end of the project, senior leadership in the participating schools said they placed a high value on professional development for all staff. Interestingly, one school commented that this also demonstrated the importance of lifelong learning to their students. This project gave technical staff in the participating schools the chance to decide on professional development specific to their needs, rather than only taking part in whole-school CPD.

Broadly speaking, the professional development undertaken by the schools fell into two categories: off-site and *in situ* professional development. Neither one proved a 'better' approach but a combination of both was found to

be most appropriate for the majority of schools. Simple steps were taken by some schools to ensure technicians could take advantage of opportunities, such as being provided with personal school email accounts in order to be able to book onto courses, and implementing a personal development plan for each technician. The aim was to build capacity across the technician team through a coordinated approach, and in some cases this was facilitated *in situ* by a technician adviser.

Some schools audited their own skill-sets and created their own internal professional development opportunities. One began a system of job shadowing to increase the team's capacity to support practical work outside their specialism. Although this reduced capacity on some days in the short term, it was outweighed by the increased skill-set of the team overall.

Many of the technicians also made use of online resources, with the technician advisers highlighting the various resource sites and communities that are aimed at technicians. A summary of these resources has already been made freely available in a 'Top Tips' leaflet as a result of this project (Gatsby Charitable Foundation, 2014).

External courses for school science technicians are provided by several organisations, including the NSLC and CLEAPSS. Attending off-site courses provided the technicians, and their departments, with fresh ideas for practical work. Keeping a technician's skills up to date can be an efficient way of improving the subject knowledge of the whole department. For example, one technician attended a microbiology training day and on returning to their school disseminated the practicals covered on the course during a twilight session for teaching staff. Several teachers then incorporated these practicals into their lessons straight away.

The external courses we all attended have given us an insight into troubleshooting practicals and assessing useful information from trusted/ recommended websites; it has also given us more confidence and knowledge to tackle even the most challenging and demanding practical. We have brought back new ideas from our courses to the school.

The in-house training has boosted our morale; we work much more in a positive atmosphere and as a team, helping each other when necessary. It has also changed the way we deliver practical to classes. We all work more confidently outside our subject specialism and at more advanced level. (Technician)

External courses were also valuable in increasing the skill-set of technicians, for example attending a course designed to prepare technicians for demonstrating in the classroom, enabling students to benefit directly from technicians' technical expertise and raising their profile. One junior school technician also attended a 12-day course run by CLEAPSS that was designed to introduce new technicians to the role and covered the delivery of practical support for all three sciences, health and safety advice and maintenance skills. This model for training new technicians was chosen in this instance because of the small size of the technician team. With only one other member of staff, it was not possible to train a new technician internally. When the newly trained technician returned, they were able to increase their support for practical work across all key stages dramatically, whereas previously they had only been able to support practicals up to key stage 3 (ages 11–14).

There was a shift in many of the schools from a system where individual technicians took sole responsibility for one subject area to a team focus. This was universally seen as a positive move, helping to reduce the impact of absences or changes in staff but also a way of being able to support more practical work across the whole department:

[Skill sharing across the technician team] *has got techs out of their comfort zone and understanding each others' positions; with a good inventory system it has allowed technicians to cover each other. This has led to a short-term gain which has been to minimise the impact on teachers and pupils when there is a technician absence. In the past technicians were not equipped to support the absence of other team members; now this impact is reduced as knowledge of others' role and expertise has been increased.* (Head of science)

External mentors and networks

Professional development opportunities also provided the chance to network with other practising technicians. Technicians attending courses found this as valuable as the course content. This was particularly true for technicians

working in smaller teams. In addition to meeting technicians on courses, there were also instances of technicians visiting other schools to see how other prep rooms were organised and managed. Discussing issues with their peers provided an opportunity for technicians to solve issues collectively and get fresh perspectives on both systems and practical work (Figure 2).

The role that the technician advisers played in this process should not be overlooked. Senior leaders, heads of department and technicians in all schools mentioned the importance of an external voice and mentor in this process. They helped to prioritise, suggested new systems, quickly solved problems, assisted in establishing local connections and networks, and advised on management and leadership techniques:

… working with an advisor/mentor is one of the best methods of enabling us to provide a better, more efficient and safer service to the Science department. The advisor is able to look at our department from the outside, recommend and prioritise improvements with the benefit of years of practical experience. (Technician)

Involving senior leaders in discussion with technician advisers at the start meant that the reputation and understanding of the role of the technician was recognised from the outset. On many occasions, the technician adviser approached senior leadership about the ideas being generated, in order to strengthen the case being made by technicians and heads of department.

In several schools, technicians were initially hesitant about the involvement of an external technician adviser; several were worried that their work practices were going to be criticised. However, the experience the technician advisers gained from the NSLC STACS course and the mentor training enabled them to ensure that the technicians retained autonomy over the activities, and could confidently engage with their teacher colleagues when planning departmental improvements.

Figure 2 Technician adviser Eileen Edwards (Saints Peter & Paul Catholic College) leading a skill-sharing session with fellow technicians at the NSLC

The cost of the technician advisers' time was covered in the core funding of the project, but their schools all recognised the value to their own institutions of taking part in the project. Strong relationships were built with local schools, the adviser's skills were enhanced and the school built its reputation within the community. Exchange of ideas occurred in both directions and several schools also began to share equipment with the technician advisers' schools. One of the schools involved has continued to support local schools after the project funding ended, demonstrating that there can be lasting value to those schools that provide support to others.

Growing the technician role

Taking the time to rationalise systems, organise prep rooms and create training plans built the confidence, morale and professionalism of all the technicians involved. Senior leaders and heads of department also appreciated this change:

Encouraging technicians to become reflective practitioners (as is the case with teachers) enables them to become more proficient and consequently more motivated and engaged in their work. They develop a better understanding of their contribution to the efficient and effective running of the Science Faculty and they appreciate that their contribution is recognised and valued. This in itself inspires greater confidence and a pride in their work and enables them to play a more proactive role. It is a win–win situation for them, for the teaching staff and for the pupils. Morale has improved significantly and working together as a team of technicians has helped them see that they are also part of the bigger Science Faculty team, contributing to a productive and successful learning environment. (Head teacher)

Several technicians involved began to expand their role once efficient systems provided the time and space to do so, with additional activities including after-school clubs, creating wall

displays, demonstrating in class and taking on a greater training role for Postgraduate Certificate in Education (PGCE) students and newly qualified teachers (NQTs):

Our chemistry technician delivered two sessions to teaching staff of little used practical demonstrations. They have found these useful and have used them in their lessons to engage students. Helping NQTs and PGCE students to gain more confidence in delivering practical lessons also has an impact. (Technician)

Targeting resources – a summary

Getting organised

Implementing efficient systems and creating a well-organised prep room are the most important steps the technical department in a school can take. But it need not be a case of rebuilding a prep room; at its simplest, it is providing technicians with the time to discuss, design and implement a system of their choosing. As one school demonstrated, this could be a day on which teachers are asked not to submit any requisitions for equipment. The benefits of doing this were seen across all seven schools involved. It was only after technicians felt confident in the systems and happy with their workspaces that additional development work could take place.

Networks and sharing

Ensuring that technicians are given the opportunity to discuss and be supported by the wider technician community is a vital and economical way of keeping the skills of technicians up to date. This could be face to face or online, but making links with a local school and seeking advice from them is invaluable. Making use of online fora and local networks can supplement the use of external courses, where cutting-edge ideas and health and safety information can be updated. To help schools take the lead and set up their own technician networks, a free booklet with advice has been produced by the NSLC (2014).

Professionalisation and recognition

Increasing the visibility of technicians is important to ensure their valuable contribution to science departments is recognised, particularly in relation to health and safety and to improving the student experience of science. Having the time to work with students in the classroom, creating an organised prep room and ensuring personal development plans are conspicuous to colleagues will ensure that both students and teachers recognise technicians as a group of professionals who are integral to the effective running of the science department:

You need to develop your technician service. If you can't deliver the service it has impact on children and staff. (Head teacher)

Involving senior leadership teams in development plans for the technician team will help ensure that they understand the importance of the technician's role. This could in turn lead to securing additional funding, safeguarding professional development days and/or ensuring sufficient numbers of technicians are employed. The ASE, CLEAPSS and the Royal Society advocate the use of a 'service factor' of 0.65 to calculate the amount of technician support needed for any given science department (Royal Society

Figure 3 Technicians in the classroom: technician adviser Phil Wilson carrying out a practical demonstration with students at Broadgreen International School

and ASE, 2002): laboratory technician hours per week = 0.65 × hours of science teaching per week.

Technicians can also have their professionalism recognised by achieving Registered Science Technician (RSciTech) status through a licensed professional body. RSciTech status is a clear indicator of the expertise and skills of technicians across science industries (www.professionalregisters.org).

Conclusion

First and foremost, technicians support practical work in the classroom by providing teachers with equipment and consumables for their lessons. But being given just a little time and space to streamline these activities can have a big impact. The technicians involved in this project demonstrated that, by being given the opportunity to choose where ring-fenced resources should be invested, they could increase departmental efficiency, improve the confidence of their teaching colleagues, and enjoy greater status and job satisfaction. The experiences of these schools has shown that investing in the professional development of science technicians should be a priority for all science departments and need not be extravagant to have impact, nor necessarily be focused on attending external courses. However, having access to an experienced and trusted technician adviser proved critical.

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References

CLEAPSS (2005) *Managing Risk Assessment in Science*. L196. Uxbridge: CLEAPSS. Available at: www.cleapss.org.uk/attachments/article/0/L196.pdf?Secondary/Science/Guides.

CLEAPSS (2009) *Designing and Planning Laboratories*. G14. Uxbridge: CLEAPSS. Available at: www.cleapss.org.uk/attachments/article/0/G14.pdf?Free%20Publications/General%20publications.

Gatsby Charitable Foundation (2012) *STEM Employers' Views on Science Skills for the Workplace*. Available at: www.gatsby.org.uk/~/media/Files/Education/STEM%20employer%20survey%20March%202012.ashx.

Gatsby Charitable Foundation (2014) *Support for Science Technicians*. Available at: www.nationalstemcentre.org.uk/elibrary/resource/11238/support-for-science-technicians [free registration required].

Grant, L. and Jenkins, S. (2011) *Practical Skills of New Undergraduates: Report on Research Workshops Delivered on Behalf of the Gatsby Charitable Foundation*. Available at: www.gatsby.org.uk/~/media/Files/Education/Practical%20skills%20of%20new%20undergraduates%20%20report%20on%20research%20workshops%20Laura%20GrantOct%202011.ashx.

Moor, H., Jones, M., Johnson, F., Martin, K., Cowell, E., Bojke, C. and PharMerit (2006) *Mathematics and Science in Secondary Schools: The Deployment of Teachers and Support Staff to Deliver the Curriculum*. Nottingham: Department for Education and Skills. Available at: www.nfer.ac.uk/publications/DMS01/DMS01_home.cfm.

National Science Learning Centre (2014) *School Science Technician Networks: A Guide to Setting One Up and Making It Succeed*. Available at: www.nationalstemcentre.org.uk/elibrary/resource/11559/school-science-technician-networks-a-guide-to-setting-up-one-and-making-it-succeed.

Royal Society and the Association for Science Education (2002) *Supporting Success: Science Technicians in Schools and Colleges*. Available at: royalsociety.org/policy/publications/2002/supporting-success.

Science Community Representing Education (SCORE) (2013) *Resourcing Practical Science at Secondary Level*. London: SCORE. Available at: score-education.org/media/11805/score%20resourcing%20secondary.pdf.

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