



## ***Discover LabSkills:*** **Evaluation report**

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## Acknowledgements

First of all, we would like to express our appreciation to the trainee teachers and tutors who made time to share their perspectives on *Discover LabSkills* with us. We would also like to acknowledge the contribution of our colleague, Sarah Metcalfe, who played a substantial part in the data collection and processing. Pippa Lord's help in refining the project report and Dr. Ben Haines' assistance with the graphics are similarly appreciated. In addition, Lorna Thomson at the RSC and partners at Pfizer, the University of Bristol and Learning Science Ltd provided support over the course of the project, and direction with regard to the shape of the final report.

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# Executive summary

## Introduction

- *Discover LabSkills* is an interactive software resource designed to help teachers – especially those new to the profession – and their students, get more out of laboratory sessions.
- This report sets out the findings of the NFER’s evaluation of the first phase of the *Discover LabSkills* project (in which the resource was issued to all chemistry teachers in training in the UK, studying the Post Graduate Certificate in Education (PGCE)).
- The data on which the report is based was gathered from 81 trainee teachers and 15 tutors by survey proforma and interview, with a subsequent focus on those (13) trainees and tutors who had made fullest use of the resource.

## Usage

- 177 trainee teachers (approximately one-third of those receiving *Discover LabSkills* in early 2009) proceeded to register with the RSC (a precondition to activating their CD).
- Data from the 81 trainee teachers participating in the evaluation (a little less than half of those registering) suggests that *Discover LabSkills* has, to date, been used primarily for professional development purposes (e.g. to refresh trainee teachers’ own skills and knowledge).
- However, trainee teachers saw considerable potential for its use with or by students (before, during and after practical sessions).

## Effectiveness and impact

- The majority of trainee teachers contributing to the evaluation reported finding *Discover LabSkills* useful, with the resource providing valuable reassurance that they were prepared for the classroom. Both trainee teachers and their tutors expected *Discover LabSkills* to prove even more useful in trainees’ first year of teaching.
- Particular strengths identified by respondents are *Discover LabSkills*’ straightforwardness, appropriate content, and linking of theory to practice. The clarification it provides of the rationale for practice is seen as especially valuable, and is thought to set *Discover LabSkills* apart from most existing resources.
- Responses to both the proforma and interview questions suggest that teachers themselves (particularly those new to the profession, e.g. trainee teachers, and

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non-specialists) can benefit in a number of ways from using the resource. Reported impacts for teachers include:

- increased knowledge and skills;
  - increased awareness of areas of difficulty or danger;
  - increased capacity to meet learners' needs; and
  - increased confidence (as practical chemists and teachers).
- Where trainee teachers have used the resource with students, feedback suggests that they perceive positive impacts on students':
    - knowledge and skills;
    - development as independent learners; and
    - feelings about practical chemistry.
  - Those trainees making the fullest use of the resource (i.e. employing it in lessons in their placement school) were particularly positive about *Discover LabSkills*' applications, value, and impact.

## Areas for development

- Feedback has been predominantly positive, but nevertheless some areas for development have been identified:
  - content: more explicit linkage to the examination syllabi was thought likely to encourage greater usage;
  - presentation: there was substantial support for the provision of an (optional) commentary and sound effects;
  - access and usage: clarification of when, where and how (with regard to the technicalities of usage) the resource could be employed would be of value.
- There appears to be an association between the receipt of support from their PGCE tutors and trainee teachers' usage of *Discover LabSkills*. Both trainee teachers and their tutors see initial support to access and explore the resource as of value.
- There are some obstacles to tutors providing this support (contact time, interdisciplinary tutorial groups and tutors' own professional knowledge), but steps are being taken by the RSC to overcome these (e.g. earlier distribution of the CD, provision of sufficient CDs for other trainee teachers where chemists are taught in interdisciplinary groups, and visits to tutors who are not chemists by training).
- Additional guidance materials would be welcomed. As experienced chemistry teachers are believed by some respondents to be better equipped to use the resource effectively, it may be helpful to involve them in the development of practice guides. We understand that there are plans for the University of Bristol to develop exemplar lesson plans using *Discover LabSkills*, with a view to making these available via the *LabSkills* website, and this would seem a positive step.

## Conclusion

- *Discover LabSkills* has certainly helped some trainee teachers to address their concerns about their subject knowledge and / or ability to communicate this to students, and impacted positively on their development as teaching professionals. There is potential for even greater impact, where trainee teachers are supported to use the resource with their students. The resource itself is seen as valuable and sound, but additional work to help new teachers surmount routine obstacles (e.g. related to the availability of appropriate resources) and to use *Discover LabSkills* creatively and effectively may be needed, if maximum impact is to be achieved.

# 1. Introduction

## 1.1 Background to the project and evaluation

In early 2009, the Royal Society of Chemistry (RSC) asked the National Foundation for Educational Research (NFER) to carry out an evaluation of the Discover LabSkills project. The main activity of this project has been the development and dissemination of the Discover LabSkills ‘dynamic lab manual’ (more details in box below and see: <http://www.labskills.co.uk/>). The Discover LabSkills project is a partnership between the RSC (Discover Chemistry team), Pfizer, Bristol ChemLabs (at the University of Bristol) and Learning Science Ltd.

### **What is a ‘dynamic lab manual’? More about *Discover LabSkills*:**

*Discover LabSkills* is an interactive software resource, covering many of the techniques and experiments included in traditional practical chemistry resources (e.g. text books or manuals). It was designed as a ‘pre-lab’ exercise, which teachers could use to help themselves and their students get more out of laboratory sessions. It gives teachers – and potentially their students – the chance to conduct ‘virtual’ experiments, with activities including: setting up equipment; taking readings; and analysing results. It offers knowledge reviews in the form of tests and quizzes with immediate feedback. The resource content is aligned with the main A-level chemistry courses, covering the key techniques and experiments on their syllabi.

The first phase of the project saw the distribution (January 2009 onwards) of the *Discover LabSkills* software (in the form of a CD) to all (around 550) trainee chemistry teachers and their tutors in Northern Ireland, Scotland, England and Wales. In total over 600 CDs were issued, with the majority going to trainee teachers via their tutors, though a small proportion (roughly five per cent) was sent directly to trainees, at their request. The project manager was aware that the timing of distribution would impact negatively on trainee teachers’ capacity to use the resource, particularly *with* students, but the concern was to get feedback of some sort as soon as possible, with a view to disseminating a revised product at the start of the 2009-10 academic year.

In order to use the software, recipients needed to register their participation with the RSC and obtain a serial number allowing the product to be activated on-line. Registration data suggests that 177 trainee teachers, on courses at over 40 different higher education institutions (HEIs), took advantage of the opportunity to access the resource.

The evaluation, which ran broadly concurrently with the first phase of the project, explored how these trainee teachers had used the resource, what sort of impacts it was perceived as having had, and areas where further development of the resource might increase its impact. This report, which has been prepared under the direction of the RSC, sets out the key findings of the evaluation.

## 1.2 Data on which this evaluation report is based

This report draws on a mix of quantitative and qualitative data, and incorporates the perspectives of both trainee teachers and their tutors. Feedback from trainee teachers was collected by **proforma** and **interview**, and from tutors by interview alone.

### The proforma

In spring 2009, the 177 trainee teachers who had registered their copy of the resource were invited to provide feedback on the resource via a proforma. The purpose of the proforma was to explore whether and how trainee chemistry teachers had used the resource, and the impacts that it had had on them, their practice, pupils and schools. Some proformas were sent directly to trainee teachers, others were passed on to trainee teachers by their tutors. A total of 81 proformas were returned to the RSC, the first 65 of which were analysed ahead of the production of an interim report in early June 2009. Six of the proformas were from students who had not apparently registered their own copy of the resource, but had used that of a colleague (each CD could be activated to run on up to three computers). In the end, 42 per cent of trainee teachers who had registered with the RSC returned a proforma (a typical response rate), plus an uncertain (but clearly smaller) proportion of non-registered trainees.



## Interviews with trainee teachers

Information from the proformas was used to select a sample of trainee teachers to approach for interview (i.e. to identify those recipients who had made the fullest use of the resource). Attempts were also made to ensure the perspectives of trainees from a range of institutions (e.g. varying in size, status and geographical location) were included. In total, 17 trainee teachers were interviewed, with a view to exploring more deeply some of the issues arising from the proforma. In addition to this body of interview data, information provided by current or prospective trainee teachers attending the ‘Excellence in Teacher Training’ workshop (held at Bristol University in June 2009) was taken into account in preparing this report.

**Figure 1: Trainee teachers receiving *Discover LabSkills*, the subset going on to register to use it, and the further subsets contributing to the evaluation by proforma and interview**

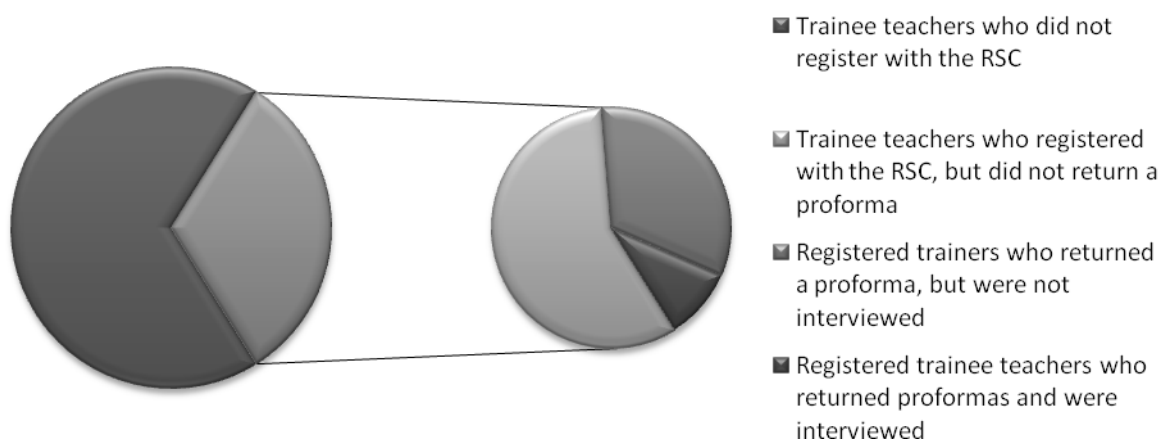


Figure 1 represents the population exposed to the *Discover LabSkills* project. The representation is indicative, and does not include figures or percentages as it is not known precisely how many trainee teachers received a copy of the CD, though it is believed to be in the region of 550. The large ‘pie’ represents these trainee chemistry teachers, with the lighter segment standing for the 177 (around 32%) who went on to register with the RSC. The second, smaller ‘pie’ provides a breakdown of the 177 registered trainees.

The largest and lightest segment of the smaller ‘pie’ represents the 102 trainee teachers who registered (58% of registered trainees), but did not respond to requests to participate in the evaluation, and about whose use, or otherwise, of the resource, nothing is known. The second largest segment of the small ‘pie’ represents the 58 trainee teachers (33% of registered trainees) who both registered and returned a proforma, but were not

interviewed. The last and smallest segment represents the 17 trainee teachers who registered, returned a proforma, *and* were interviewed (10% of those registering). Please note these percentages do not sum to 100 due to rounding.

### Interviews with PGCE tutors

All (45) registered tutors were invited to participate in a telephone interview, with the expectation (based on information from the trainee teacher proformas) that a small number would be in a position to comment on trainees' use of the resource. Fifteen agreed to provide information to the evaluation team (in one case by email). None of the tutors interviewed had seen the resource in use in a school setting, but nevertheless they provided useful insights on how the resource might fruitfully be introduced to, and used by, trainee teachers, and on the factors encouraging or discouraging the usage of *Discover LabSkills*.

#### Introduction: Key points

- *Discover LabSkills* is an interactive software resource designed to help teachers – especially those new to the profession – and their students, get more out of laboratory sessions.
- This report sets out the findings of the NFER's evaluation of the first phase of the *Discover LabSkills* project (in which the resource was issued to all chemistry teachers undergoing PGCE training in the UK).
- The data on which the report is based was gathered from 81 trainee teachers and 15 tutors by survey proforma and interview, with a subsequent focus on those (13) trainees and tutors who had made fullest use of the resource.

## 2. How has *Discover LabSkills* been used?

This chapter describes how trainee teachers contributing to the evaluation used *Discover LabSkills*, looking firstly at how trainees made use of it for their own professional development purposes, and secondly at how it had, in a small number of cases (13), been used with students in placement schools.

### 2.1 Use of the CD for professional development purposes

It was most common for proforma respondents and interviewees to report having made use of the resource for their own professional development purposes (rather than using it in school). Around three-quarters (12) of the 17 trainee teachers interviewed told us they had used the resource, in their own time, for professional development reasons. Specific activities included:

- **refreshing their knowledge of a particular topic or technique, including ‘practising’ for a demonstration.** One proforma respondent, for example, noted that ‘For me, it has been a fantastic reference resource, very clearly explaining the correct scientific set up, procedure, safety, and experimental outcomes of techniques and experiments’ and another that it ‘Helped me to double-check some of my subject knowledge’. Similarly, one interviewee told us ‘I’ve used it for revision, just for myself’ and another that ‘I’ve used it first and foremost to refresh my [own] skills and knowledge’.
- **considering how to explain and communicate important ideas and information to students, including how to structure and contextualise information.** One proforma respondent, for example, remarked that ‘It allowed me to see an alternative perspective for teaching the skills’, whilst others noted how it had helped increase their awareness of how work could be broken down into small steps, and clear instructions provided for each stage. In this vein, an interviewee told us that it ‘helps in lesson planning, like how I would go about explaining this, and at what point could I introduce this concept, that concept, or this work. So it helps me in focussing on the ‘flow’ of the lesson’.

Comments from trainees and their tutors suggest that the balance of these activities has varied in line with trainees’ background and experience. For example, trainees who had done little practical chemistry in the years prior to beginning teacher training used the resource to improve their knowledge and

skills in areas such as infra-red spectroscopy, oxidation and titration (the latter process is one of several on the CD which also has relevance to trainee teachers delivering key stage 4 programmes). In contrast, trainees who had been working in specialist areas of chemistry, and were confident about their own skills and knowledge, were looking for a steer on how they might impart these to their students (i.e. they saw the resource as having *pedagogical*, as opposed to *substantive* uses).

## 2.2 Use in schools

13 out of 81 proforma respondents, and five out of the 17 trainees interviewed, had used the resource in their placement school. Reasons for not using the resource in school, where given, included:

- lack of opportunity to work with AS chemistry students;
- technical limitations relating to either:
  - ICT provision within the placement school, or
  - the resource itself (or rather to the controls over access currently in place) ; and
- lack of time to think about how the resource might be used.

However, though trainees who had used *Discover LabSkills* with students at the time of the research were in the minority, many others had given thought to how they might use it, were an appropriate opportunity to arise. Trainee teachers identified a host of potential uses for the resource: before, during and after practical sessions. They saw the resource as having application to several different strands of the teaching and learning process, specifically:

- the introduction of new techniques, activities and topics;
- as a check on students' understanding;
- for recap and revision purposes; and
- to extend learning.

Trainees told us how they had used, or would like to use, *Discover LabSkills* **to introduce new topics and techniques to students** (for example, titration, reflux, distillation and oxidation) instead of giving a description or a conventional demonstration. One interviewee described in detail how they would go about this:

*If they were going to do a practical – like a lesson coming up – I’d ... run through it on the whiteboard in advance, talk them through it, through the safety [issues] regarding the experiment before doing it. So that was my responsibility, but also they were taking responsibility over it and really looking at it. And that would mean in the lesson, when they actually came to do the experiment, you wouldn’t get a thousand questions at the beginning, they’d have a bit more of an idea of what they should be doing, because they’d have seen it (Trainee teacher).*

Access arrangements permitting, trainee teachers would also like to ask students to look at specific sections of the resource independently, ahead of practical sessions. They envisaged, on occasion, targeting such tasks at students who would particularly benefit from additional time to process information (for example, students speaking English as a second or additional language).

In various ways, the resource was – or, we were told, potentially could be – used **as a check on students’ understanding**. Some trainee teachers had already used the resource’s quizzes, short tests and interactive sequences for this purpose. One interviewee told us how, on completion of a practical activity, they used the resource to show how things *should* be done, with students being encouraged to identify ways in which this differed from what they had done. The discussion informed the teacher on students’ awareness of key principles, and also encouraged students to develop the skill of self-correction.

*Discover LabSkills* has also been used **to reinforce, recap and review learning**. Due to the limited opportunities for AS-level students to conduct practicals and refine their techniques, the resource’s use as a revision tool was one that trainee teachers saw as a particularly obvious and useful application.

Several trainee teachers also described how the resource had been, or might be, used **to extend students’ learning**. It was suggested that the potential to extend learning might be exploited either through teacher-facilitated work in class, or – access arrangements permitting once again – by ‘devolving’ work to students (individuals or small groups). Interviewees additionally noted how the resource provided a context for important techniques, and also how it

could be used to simulate experiments in class which students were otherwise unlikely to have exposure to<sup>1</sup>.

**Usage: Key points**

- Approximately one-third of the trainee teachers receiving *Discover LabSkills* proceeded to register with the RSC (a precondition to activating their CD).
- Data from the trainee teachers participating in the evaluation (a little less than half of those registering) suggests that *Discover LabSkills* has, to date, been used primarily for professional development purposes (e.g. to refresh trainee teachers' own skills and knowledge).
- However, trainee teachers saw considerable potential for its use with or by students – before, during and after practical sessions.

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<sup>1</sup> A variety of explanations were offered for not being able to conduct an actual practical: pressures of time; lack of resources (sometimes specialist or expensive equipment is required); and safety considerations.

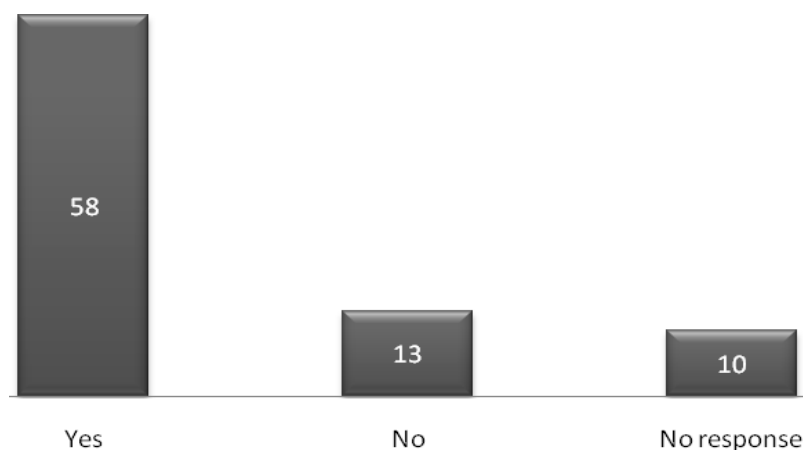
## 3. Effectiveness and impact

### 3.1 General impressions

The previous chapter sets out how trainees had used the resource to support the development of their own skills. Though some highly experienced chemists choose to train as chemistry teachers, comments from interviewees – both trainee teachers and their tutors – suggest that it is fairly common for trainees to have some concerns about either (a) their skills and knowledge or (b) their ability to communicate these effectively to students. Some tutors expressed concern that where trainees and teachers lack confidence in their own knowledge or skills, they may avoid doing practical work with their students. Inasmuch as the resource can be used to address these perceived gaps, *Discover LabSkills* may influence not only how, but actually if, trainee and new teachers take full advantage of opportunities to do practical work.

Trainee teachers who completed the evaluation proforma were asked to indicate if they had found the resource useful; a clear majority (58 out of 81) said they had (see Figure 2, over page). Tutors emphasised that there is limited opportunity within the PGCE programme to develop subject knowledge, and that the responsibility to address real or perceived gaps therefore falls on trainee teachers themselves. Trainee teachers told us they found it reassuring to have a means of: reminding themselves of ‘the basics’; checking that they had considered all the dangers and pitfalls that students might encounter; and getting a steer on how techniques (and concepts) might be communicated. In short, *Discover LabSkills* provided valuable reassurance to trainee teachers that they were prepared for the classroom. *Discover LabSkills* was also seen as enabling teachers to cope with, and maximise the impact of, scarce resources in terms of equipment, laboratory space, and time. It was suggested that it could potentially encourage innovation, collaborative learning, and devolution of responsibility for learning from teachers to students.

**Figure 2: Trainee teachers' responses to the proforma question 'Have you found the LabSkills resource useful?' (n=81)**



Trainee teachers and tutors anticipated trainees having more opportunity to teach AS-level chemistry in their first year of teaching, and therefore expected the resource to become yet more useful during the early professional development (EPD) phase. At this stage they should, according to one tutor, be 'beginning to try things out, and to demonstrate making use of resources for their own portfolio'.

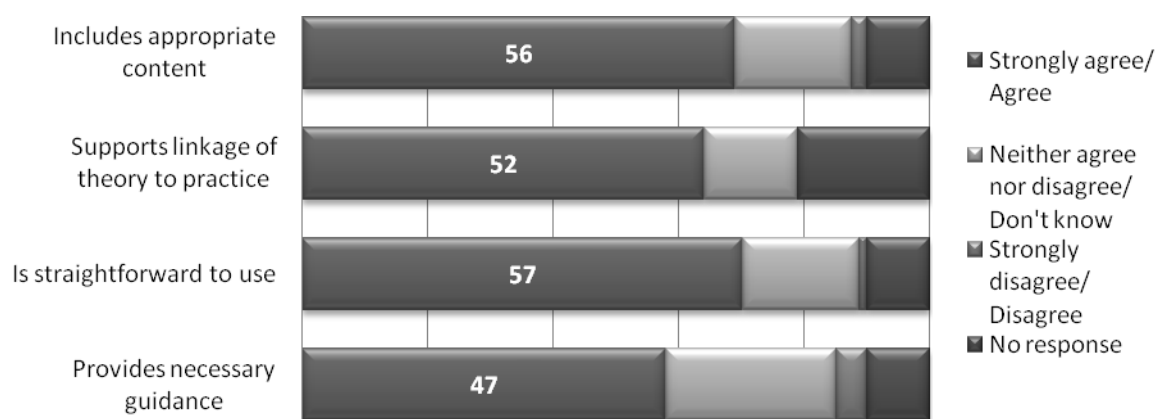
*When you're in your probation year you've got the class for the entire year, so you can plan what you're doing and you can incorporate the LabSkills within your lessons. That's what I was hoping to do (Trainee teacher).*

### 3.2 Specific features and strengths

Proforma respondents were asked to indicate their agreement – or otherwise – with a series of descriptions of the resource (see Table A1 in the Appendix). The proforma responses, and comments subsequently made by interviewees, suggest that there were many features of *Discover LabSkills* that trainee teachers and their tutors valued.



**Figure 3: Trainee teachers' responses to statements made on the proforma about the features and qualities of *Discover LabSkills* (n=81)**



The proforma included 14 statements about the features and qualities of *Discover LabSkills*. Respondents were asked to indicate their agreement, or otherwise, with each of these statements. More than half the sample agreed (or strongly agreed) with seven out of the 14 statements, and the chart above highlights responses to four of these statements which are discussed in conjunction with the qualitative data in the sub-sections immediately below. The remaining three statements, which relate to the impact of the resource on trainee teachers' practice, are considered in section 3.3.

## Content

A little less than three-quarters of the proforma respondents (**56 out of 81**) strongly agreed or agreed that the resource included 'appropriate content' and some interviewees saw a clear fit with the AS curriculum (the fit with the Scottish Higher syllabus was reported as being less satisfactory). A few felt the links to specific syllabi could be made more explicit. Several interviewees remarked on how comprehensive the resource was, seeing it as covering all key techniques and experiments: 'The content is very good, it covers lots of different points'. In terms of *how to* conduct practical work, several interviewees described it as having the necessary, but not excessive, amount of detail.

Just under two-thirds of proforma respondents (**52 out of 81**) strongly agreed or agreed that the resource 'supports the linkage of theory to practical work' and comments from interviewees suggest that the information on *why to* – i.e. the theory or rationale behind practice – is very valuable:

*This is a bit less dense than some of the best 'How to?' chemistry practical stuff, and there's more emphasis on the 'Why to?' I think it's very nicely complementary to existing detailed guidance on specific practicals*

(PGCE tutor).

The interactive features were also popular ('really nice'), in particular the tests and quizzes, which were thought to provide a useful check on (trainees' and students') knowledge:

*I think the models – the animations of what they were supposed to be looking for – were really good. Where you can see quite clearly all the different things that you're changing, and the variables. And you know there are parts where you can test your knowledge and your understanding – that's good as well*

(Trainee teacher).

## Presentation

Overall, the information was thought to be well presented. On the whole tutors and trainees appeared to like the visuals, the colour coding and the layout of pages. However, responses to both the proforma and interviews suggest that some small presentational adjustments might be welcomed (discussed in the Interim Report and in section 4.1).

## Ease of use

Slightly less than three-quarters of proforma respondents (**57 out of 81**) strongly agreed or agreed that *Discover LabSkills* was 'straightforward to use' and around three-fifths (**47 out of 81**) trainees strongly agreed or agreed that the resource included the 'necessary guidance'. Interviewees commented that it was 'easy to navigate', 'user-friendly' and 'pretty self-explanatory'. Feedback from interviewees suggests that the resource is well structured. Clear layout and indexing enabled most users to locate relevant activities and information with ease, and some interviewees thought it was 'much easier to use that, than to look it up in the book'. Both trainee teachers and tutors liked how information was broken down into small 'chunks' ('it means you can focus on one point at a time') and provided in a step-by-step fashion.

### What do those trainee teachers who made fullest use of the resource think? Data from the proformas

Focusing in on those trainee teachers who had made fullest use of the resource, i.e. employing it in lessons in their placement school, proforma responses (n=13, see note below and Table 1, over page) suggest that these teachers were particularly convinced of *Discover LabSkills*' value, with more than half strongly agreeing or agreeing that the resource:

- includes *appropriate content* (12 respondents);
- is *straightforward to use*, and enables teachers to provide additional *support* to less confident students (11 respondents);
- supports the *linkage of theory to practical work*, allows more *time for discussion* around practical work, and enables *topics to be covered* using practicals that might otherwise not be (ten respondents);
- enables the *learning of more able students* to be extended, and includes the *necessary guidance* for users (nine respondents);
- *saves time* preparing for lessons, and enables teachers to be *more ambitious* (eight respondents); and
- helps teachers to *maximise the effectiveness* of their practical lessons (seven respondents).

**Table 1**, over page, provides a detailed breakdown of the responses of the 13 'full users' to the 14 statements on the proforma about the features and qualities of *Discover LabSkills*.

**Table 1: 'Q5. Please say to what extent you agree or disagree with the following statements about the LabSkills resource' Responses from trainee teachers who indicated they had used LabSkills with students in their placement school (n=13) ranked by those strongly agreeing / agreeing**

LabSkills:	Strongly agree / agree	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Strongly disagree / disagree	Don't know	Neither / Don't know
Includes <i>appropriate content</i>	<b>12</b>	3	9	0	0	0	<b>0</b>	1	<b>1</b>
Is <i>straightforward</i> to use	<b>11</b>	4	7	2	0	0	<b>0</b>	0	<b>2</b>
Enables you to <i>provide more support to students who are not confident</i> in undertaking practicals	<b>11</b>	4	7	1	0	0	<b>0</b>	1	<b>2</b>
Supports the <i>linkage of theory to practical work</i>	<b>10</b>	4	6	2	0	0	<b>0</b>	1	<b>3</b>
Allows <i>more time for discussion</i> around the practical work to aid understanding	<b>10</b>	1	9	2	0	0	<b>0</b>	1	<b>3</b>
Enables <i>topics to be covered using practicals which otherwise might not be delivered in this way</i>	<b>10</b>	4	6	1	1	0	<b>1</b>	1	<b>2</b>
Enables you to <i>extend the learning of more able students</i>	<b>9</b>	3	6	3	0	0	<b>0</b>	1	<b>4</b>
Provides the <i>necessary guidance</i> to explain how it should be used	<b>9</b>	2	7	3	1	0	<b>1</b>	0	<b>3</b>
<i>Saves you time</i> in preparing for practical lessons	<b>8</b>	2	6	4	0	0	<b>0</b>	1	<b>5</b>
Enables you to be <i>more ambitious</i> when planning and delivering practical lessons	<b>8</b>	2	6	4	0	0	<b>0</b>	1	<b>5</b>
Helps to <i>maximize the effectiveness</i> of timetabled AS-level practical lessons	<b>7</b>	1	6	5	0	0	<b>0</b>	1	<b>6</b>
Enables <i>more ground to be covered</i> in AS-level practical lessons	<b>6</b>	1	5	6	0	0	<b>0</b>	1	<b>7</b>
Is an <i>invaluable resource</i> for both planning and delivering practical lessons	<b>6</b>	3	3	5	0	1	<b>1</b>	1	<b>6</b>
Includes <i>all you need to know</i> to deliver AS practical chemistry	<b>6</b>	1	5	4	2	0	<b>2</b>	1	<b>5</b>

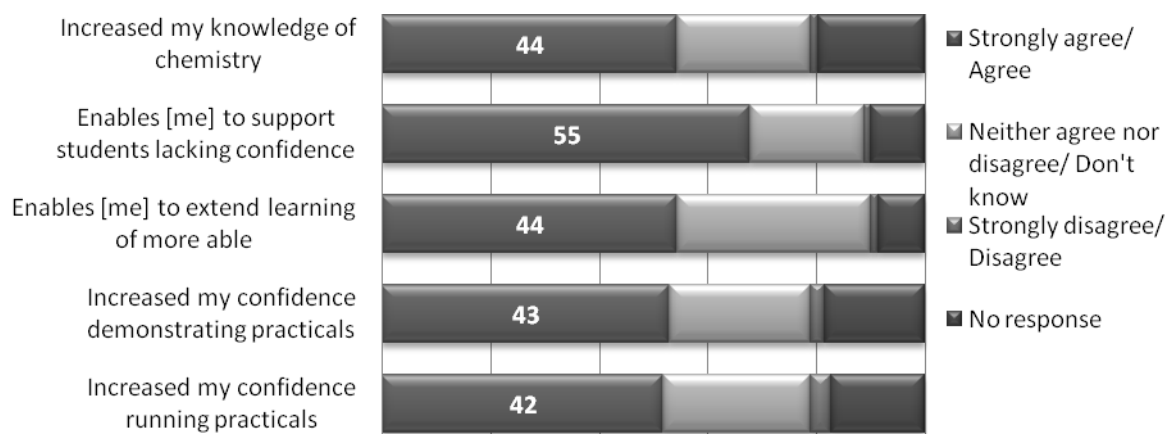
### 3.3 Perceived impacts

#### Benefits for teachers: impacts on professional development

Trainee teachers were asked to confirm (see Table A2 in the Appendix) or identify the impact the resource had had on them as a teacher. Both trainees and their tutors were also encouraged to reflect on the (actual and potential) benefits for teachers more widely. The data suggests that teachers – particularly those new to the profession and non-specialists – can benefit in a number of ways from using the resource. However, **four areas of impact on trainees stand out:**

- on their own **knowledge and skills;**
- on their **awareness of areas of difficulty for students** and of safety issues their students might overlook;
- on their **capacity to meet learners' needs;** and
- on their **confidence as practical chemists and teachers.**

**Figure 4: Trainee teachers' responses to statements made on the proforma about the impact of *Discover LabSkills* on them and their practice (n=81)**



The proforma included eight statements directly relating to the impact of *Discover LabSkills* on trainee teachers and their practice. Respondents were asked to indicate their agreement, or otherwise, with each of these statements. More than half the sample strongly agreed or agreed with three out of the eight statements, and the chart above highlights responses to these three statements. In addition, Figure 4 shows the responses to three other statements relevant to this theme appearing earlier in the proforma. All statements are discussed in conjunction with the qualitative data in the sections below.

### Impact on trainee teachers' knowledge and skills

Responses to both the proforma and interview questions suggest that – where time is invested in the use of *Discover LabSkills* – there can be ‘returns’ in the form of increases in trainee teachers’ knowledge. Just over half of the trainee teachers completing the evaluation proforma (**44 out of 81**) either agreed or strongly agreed with the suggestion that the resource ‘has increased my knowledge of chemistry’. Only one responding trainee disagreed. Some expanded on their responses with comments such as ‘my chemistry knowledge has definitely increased’. Interviewees made similar points, one trainee teacher noting, for example, that the resource had ‘broadened [my] subject knowledge’. Tutors saw the resource as having the potential to impact very positively on trainee teachers’ understanding of the *basis* for practice:

*What I find problematic, is that people who've done lots of chemistry know you read burettes to two decimal places, but they haven't really thought about why. They have a very low level of criticality of accepted practical practice. One of my jobs is to get them to be more skilled in that for themselves, so that they can help their students to feel OK to say 'Why does it matter if I don't do this?' And I think that the way [Discover LabSkills] is set out, encourages and supports them to think a little bit more about why they do it this way*

(PGCE tutor).

### Impact on trainee teachers' awareness of areas of difficulty

Many of the trainee teachers and tutors to whom we spoke said the resource helped teachers put themselves in students’ shoes and raised their awareness of the difficulties and safety issues associated with procedures and which might present problems for less experienced chemists (i.e. their students). For example, trainees told us:

*It made me more aware of the issues that they [the students] have got to think about when they're doing practical work ... it's brought my attention to safety issues, and [to] areas that children might find conceptually quite difficult*

(Trainee teacher).

*It did highlight some of the silly things that you might just miss out ... [including the] safety aspects ... things like don't pour liquids at eye-level. That really came over quite strongly [and] it made me remember just what it is at school-level that you need to teach*

(Trainee teacher).

### Impact on trainee teachers' capacity to meet learners' needs

In various ways, *Discover LabSkills* was seen as helping teachers to meet learners' needs more effectively. Around two-thirds of trainee teachers returning the evaluation proforma (**55 out of 81**) agreed or strongly agreed with the statement that the resource 'enables you to provide more support to students who are not confident', and over half (**44 out of 81**) that it 'enables you to extend the learning of more able students'. The resource itself, according to some interviewees, 'caters for all different types of learners', accommodating different learning styles, levels of competence in the English language, and aptitude for practical science. In this respect it supported differentiation:

*It's such a good differentiation tool, because of all this problem solving ... able students could just do the problems without the help that's built into the software. But if someone needs more help, they could go through the problem-solving step-by-step, and it's all clearly laid out. So that's one of the beauties of LabSkills*

(Trainee teacher).

### Impact on trainee teachers' confidence

The resource was considered by both trainee teachers and their tutors to impact positively on trainees' confidence in facilitating practical work. Just over half of the trainees completing the evaluation proforma (**43 out of 81**) agreed or strongly agreed with the proposal that *Discover LabSkills* 'increased my confidence in demonstrating practical science', and a similar proportion (**42 out of 81**) with the statement that it 'increased my confidence in running practical sessions'. Interviews revealed that – for a variety of reasons – many trainees had considerable anxiety about demonstrating and facilitating practical work, and *Discover LabSkills* has helped to mitigate these concerns:

*It has given me more confidence when it comes to practical work and I have not felt the need to shy away from any practical work, because I know there is help available to me*

(Trainee teacher).

This, in the opinion of one tutor, could be a very valuable outcome:

*There is a lot of potential there, and it is a very interesting project. I think it's great that there is something to support practical skills, because some of my chemists actually did very little practical work in school, and then they have perhaps done something quite specialised*

*when they were doing their degree, so they don't feel confident about the basic stuff. We don't want to be in this self-perpetuating cycle of teachers being unconfident about practical skills and so therefore not teaching them. It could be very useful for that*

(PGCE tutor).

### **What do those trainee teachers who made fullest use of the resource think? Data from the proformas**

Again, it is worth highlighting that the 13 trainee teachers who had used the resource in school were particularly positive in their responses. Of the 13 respondents who had used the resource in this way:

- Eleven strongly agreed / agreed that it had made their lessons *more enjoyable and engaging*, and increased their *confidence* in running practical sessions with students;
- ten strongly agreed / agreed that it had increased their *knowledge* of chemistry, and their *confidence in demonstrating* practical science; and
- nine strongly agreed / agreed that it had increased their *skills* in running practical sessions with students, and that it had enabled them to deliver a *greater variety* of practical lessons than would otherwise have been possible.

**Table 2**, over page, provides a detailed breakdown of the responses of the 13 'full users' to the eight statements on the proforma directly relating to the impact of *Discover LabSkills* on trainee teachers and their practice.



**Table 2: 'Q10. Please say to what extent you agree or disagree with the following statements regarding the impacts of *LabSkills* on you as a teacher' Responses from trainee teachers who indicated they had used *LabSkills* with students in their placement school (n=13) ranked by those strongly agreeing / agreeing**

	Strongly agree / agree	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Strongly disagree / disagree	Don't know	Neither / Don't know
It has made my lessons <i>more enjoyable and engaging</i> than they otherwise might have been	<b>11</b>	2	9	0	1	0	<b>1</b>	0	<b>0</b>
It has increased <i>my confidence</i> in running practical sessions with students	<b>11</b>	6	5	0	2	0	<b>2</b>	0	<b>0</b>
It has increased <i>my knowledge</i> of chemistry	<b>10</b>	2	8	2	0	0	<b>0</b>	0	<b>2</b>
It has increased <i>my confidence in demonstrating</i> practical science	<b>10</b>	4	6	2	1	0	<b>1</b>	0	<b>2</b>
It has increased <i>my skills</i> in running practical sessions with students	<b>9</b>	3	6	3	1	0	<b>1</b>	0	<b>3</b>
It has enabled me to deliver <i>a greater variety</i> of practical lessons than I would have been able to deliver otherwise	<b>9</b>	2	7	3	1	0	<b>1</b>	0	<b>3</b>
It has increased <i>the time in lessons that I have been able to spend on doing practical work</i> rather than preparing for it	<b>6</b>	1	5	6	1	0	<b>1</b>	0	<b>6</b>
It has enabled me to deliver <i>a larger number</i> of practical lessons than I would have been able to deliver otherwise	<b>6</b>	2	4	6	1	0	<b>1</b>	0	<b>6</b>

### Benefits for students: impacts on students using the resource

A small minority of trainee teachers appear, to date, to have used *Discover LabSkills* in school. The reasons for this are discussed in section 2.2, and, insofar as they relate to the timing of the distribution of the CD, were largely anticipated by those managing the project. However, data from these trainee teachers and their tutors provides some indication that **where the resource is used in schools, impacts for students may be achieved in the following areas:**

- on students' **knowledge and skills;**
- on students' **development as independent learners;** and
- on students' **feelings about practical chemistry,** including their confidence.

### Impact on students' knowledge and skills

Several trainee teacher interviewees suggested that the use of the resource might impact positively on students' chemistry knowledge and skills. The opportunity to prepare for, review, catch up on or extend practical work was thought (potentially at least) to embed and refresh knowledge and skills:

*I think it would be a great advantage to the students to be able to use that resource to do their revision – because there's no chance really for them to re-do the practicals. This kind of software would be absolutely useful, just to remind them of what they have done in the past*

(Trainee teacher).

It was also perceived as helping to broaden students' understanding of practice, in particular of its basis or rationale (i.e. why things need to be done in a particular way) and to encourage critical thinking. This could be particularly beneficial where a syllabus requires students to conduct an independent enquiry. One interviewee told us that:

*We use the Salters' course, so they have to do an investigation at A2. We felt that the [resource] would really help them to think about their planning and evaluation when they come to do that*

(Trainee teacher).

### Impact on students' development as independent learners

Tutors noted how the resource provided opportunities to devolve work – and responsibility for their learning – to students. It helped clarify what students needed to know, provided immediate formative feedback, and promoted their development as independent and self-directed learners.

### Impact on students' feelings about practical chemistry

Both trainees and tutors felt that the resource could impact positively on students' feelings about practical chemistry – reducing anxiety and increasing confidence and enjoyment. A key factor in this was thought to be the removal of pressures (for example, to do with: the time available to process and act on information; the need to perform well under the scrutiny of one's peers; and arising from 'task loading', i.e. simultaneously meeting new procedural and physical challenges):

*A thing I liked about it was that if each child could access it individually, they could work through at their own speed. Because some children you just find aren't naturally very good at practicals... It means that there isn't any peer pressure within the class, [to fuel] that fear of practicals. Doing it on there first, it's safe... they can do whatever they want, and it doesn't matter*

(Trainee teacher).

*I particularly liked some of the titration stuff; that it could get the students, really kind of trying it out without worrying about the equipment. In many ways there is sort of a procedural element to titration and then there's the actual manipulation element. And asking the students to try and physically make their fingers do things, as well as managing the mental process of what needs doing when and 'how do I make it precise and accurate?' [is quite a lot]. Those two things can often impact on each other in a very negative way. Whereas [with Discover LabSkills] you can get them through the procedure without having to have that manual [element] explained, and then introduce that. That's what I liked about it*

(PGCE tutor).

### What do those trainee teachers who made fullest use of the resource think? Data from the proformas

The 13 trainee teachers who had used *Discover LabSkills* in school were very positive about the impacts of the resource on students, with most strongly agreeing or agreeing with suggestions that the resource had impacted positively on students' engagement, confidence and skills. Of the 13 respondents using the resource in school:

- ten strongly agreed / agreed that it had contributed to the development of *students' practical skills*, and had increased *students' engagement in practical chemistry*;
- nine strongly agreed / agreed that it had contributed to the development of *students' thinking skills*, and developed *students' confidence* in practical chemistry; and
- seven strongly agreed / agreed that it had increased students' *engagement in chemistry more generally*, and could ultimately increase *students' likelihood of continuing with chemistry* in employment and / or higher education.

**Table 3**, over page, provides a detailed breakdown of the responses of the 13 'full users' to the six statements on the proforma relating to the impact of *Discover LabSkills* on the students taught by trainee teachers.

It seems that though there are some benefits which might be realised without students ever having direct exposure to the resource (i.e. students indirectly benefiting from their teachers' use of the resource), there are additional benefits which may be accrued where *Discover LabSkills* is used *with* students and schools. Approximately four out of five trainee teachers participating in the evaluation – 64 out of 81 proforma respondents – indicated that they believed the impact of the resource would be increased, if their students were enabled to access the resource independently, from home.

**Table 3: 'Q11. Please say to what extent you agree or disagree with the following statement regarding the impact of *LabSkills* on the students you taught' Responses from trainee teachers who indicated they had used *LabSkills* with students in their placement school (n=13) ranked by those strongly agreeing / agreeing**

	Strongly agree / agree	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Strongly disagree / disagree	Don't know	Neither / Don't know
It has contributed to the development of <i>students' practical skills</i>	<b>10</b>	3	7	2	1	0	<b>1</b>	0	<b>2</b>
It has increased <i>students' engagement in practical chemistry</i>	<b>10</b>	2	8	2	1	0	<b>1</b>	0	<b>2</b>
It has developed <i>students' confidence in practical chemistry</i>	<b>9</b>	2	7	3	1	0	<b>1</b>	0	<b>3</b>
It has contributed to the development of <i>students' thinking skills</i>	<b>9</b>	2	7	3	1	0	<b>1</b>	0	<b>3</b>
It could ultimately <i>increase students' likelihood of continuing with chemistry</i> in employment and/or higher education	<b>7</b>	2	5	4	1	0	<b>1</b>	0	<b>4</b>
It has increased <i>students' engagement in chemistry more generally</i>	<b>7</b>	1	6	5	1	0	<b>1</b>	0	<b>5</b>

**Effectiveness and impact: Key points**

- Most trainee teachers contributing to the evaluation reported finding *Discover LabSkills* useful, with the resource providing valuable reassurance that they were prepared for the classroom. Both trainee teachers and their tutors expected *Discover LabSkills* to prove yet more useful in trainees' first year of teaching.
- Particular strengths identified by respondents are *Discover LabSkills*' straightforwardness, appropriate content, and linking of theory to practice. The clarification it provides of the rationale for practice is seen as especially valuable, and is thought to set *Discover LabSkills* apart from most existing resources.
- Responses to both the proforma and interview questions suggest that teachers themselves (particularly those new to the profession, e.g. trainee teachers, and non-specialists) can benefit in a number of ways from using the resource. Reported impacts for teachers include:
  - increased knowledge and skills;
  - increased awareness of areas of difficulty or danger;
  - increased capacity to meet learners' needs; and
  - increased confidence (as practical chemists and teachers).
- Where trainee teachers have used the resource with students, feedback suggests that they perceive positive impacts on students':
  - knowledge and skills;
  - development as independent learners; and
  - feelings about practical chemistry.
- Those trainees making the fullest use of the resource (i.e. employing it in lessons in their placement school) were particularly positive about *Discover LabSkills*' applications, value, and impact.

## 4. Maximising the impact: Areas for development

### 4.1 Refining the resource

Feedback on *Discover LabSkills*, whether via proforma or interview, has been predominantly positive. However, both proforma respondents and interviewees identified some areas where further development might add to the impact of the resource. Comments focused on the following areas:

- content (and linking this to the curriculum);
- presentation; and
- access.

#### Content

In addition to the many positive comments that were made about the content of the resource, a few suggestions were made as to how it might be improved and enhanced. A few trainee teachers said they would like to see the resource expanded to enable its use at KS3, KS4 or A2 level (The full AS and A2 combined resource is now complete and will be used in Phase 2.). Some interviewees thought *Discover LabSkills* would be improved by the inclusion of additional content (e.g. careers information, a glossary, and more details of how experimental errors arise). In contrast, however, another interviewee told us they felt that there was already too much ground covered, and the resource would be more useful if it focussed on a few key procedures common to all the examination boards.

This focus on exam preparation was evident in a number of trainee teachers' responses and it was suggested that the clarity of *Discover LabSkills*' links to the examination syllabi might be a determinant of trainee teachers' use of the resource. If this is true, then fuller usage might be encouraged by the inclusion of some sort of 'curriculum timeline' (mapping the content of the resource against AS syllabuses) and by encouraging schools to 'flag up' opportune points to use *Discover LabSkills* in their schemes of work. We understand that

the RSC and partners are already exploring how they might provide additional guidance to support this.

### Presentation

Two points were made recurrently in relation to presentation, the first of these being the need to ensure that all animations and video segments could be opened up to ‘full screen’ view. Secondly, there was substantial support for the addition of a commentary (perhaps optional) and sound effects, though some interviewees recognised that there were arguments for not making these available (e.g. potentially distracting, encourages passivity). In addition, sound could present a safety issue, were the resource to be used in a laboratory setting.

### Access and usage

About one-sixth of proforma respondents (12 out of 81) and one-third of interviewees (ten out of 31) reported that either they – or, in the case of tutors, some of their students – had had difficulties accessing and using the resource. Comments made on returned proformas suggest that setting up an access code was seen as time-consuming and laborious, that a few CDs may have been faulty, and that internet access (necessary to activate the resource on a particular computer) was difficult to gain in some schools<sup>2</sup>. However, we understand that these difficulties have been largely addressed by the RSC and partners. For example, the codes have been simplified and will be issued with the next batch of CDs (as opposed to separately, on request). This could have a substantial and positive impact on the uptake of the resource, as several tutors emphasised the pressures trainee teachers were working under, and warned that these pressures result in trainees making a crude analysis of costs and benefits, with each additional step in the access process reducing the likelihood of use being made of a resource.

The requirement to have computers with CD-drives precluded the use of the resource in some schools, and the limited licensing arrangements (use on a maximum of three computers) meant that *Discover LabSkills* could only be used with large groups and on designated machines (a problem for trainees

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<sup>2</sup> Internet access was only necessary when initially activating the software on a particular computer. However, comments from trainee teachers suggest that some were under the impression that ongoing internet access was required.



who were ‘all over the place and weren’t allowed to take [their own] laptops around’). Interviewees’ comments suggest that making the resource accessible from multiple sites through schools’ ‘Virtual Learning Environments’ (VLE), as will be possible with the commercial version of the resource, would be a very welcome step. As regards the free version, clarification and guidance on when, where, and how it could be used, and which takes into account the different IT arrangements in schools, might encourage wider usage.

## **4.2 Promoting effective usage: Support and guidance**

### **Support and use of the resource**

The data suggests that there may be some association between the receipt of support or guidance on the use of the resource (from either a tutor or school-based mentor) and its employment generally and in school.

### Support to use the resource

Around a quarter of all trainees completing the evaluation proforma (23 out of 81) reported having received encouragement and support to make use of *Discover LabSkills*. This support included being guided through the resource and receiving suggestions as to when and how it might be used. Support tended to come from PGCE tutors at the time of distribution, though a few trainee teachers told us (in interview) that they had discussed the resource with their school supervisor. Tutors saw their role as helping trainees to:

- explore the resource;
- understand the pedagogy behind it;
- think about how *Discover LabSkills* might be used to support teaching and learning; and
- identify where (i.e. at which points in different syllabi) it might be used.

We know from proforma and interview data that this sort of support was welcomed by trainee teachers (both those who had received it and those who had not). In particular, trainees would welcome (more) support on how to navigate around the resource, how to use it in the classroom (over and above for demonstration purposes) and how to identify opportunities (points in the curriculum) where it might be suitable for use.

A tutor who had given over an afternoon to exploring the resource with their trainees offered the following reflection:

*I would suspect that if I hadn't have done that, I wouldn't have seen much value out of it. I would have expected a much lower 'hit rate', if I hadn't at least opened it with them and said 'Let's have a look at what's inside this'. Just handing it to them, I wouldn't have expected many to [have made use of it]. They'd have been just so busy with other things that, with great intentions, few of them would have got round to opening it*

(PGCE tutor).

Several of the tutors who had not actively introduced the resource to their trainees agreed that the resource is more likely to be used where encouragement is provided. These tutors said they wished they had been able to promote the resource more actively, and that they hoped to integrate it into the course in the next academic year. However, tutors emphasised that their

‘contact time’ with trainees was very limited, and concentrated at the beginning of the academic year, so they needed to receive the revised resource as early as possible and ideally by September<sup>3</sup> (which should be the case in the next phase of the project):

*We are fairly locked in to what we are going to do and ... you have such limited time that you plan a lot in advance. If I had had the resource in September when the course had actually started, I could have used in that first six-week block, and got the students used to using it and being aware of it*

(PGCE tutor).

Another issue for tutors on general science courses was that chemists were seen primarily in inter-disciplinary groups, and therefore dedicating a session to the resource would be difficult unless the RSC was willing to provide additional copies of the resource for other trainees (e.g. those with a physics degree). Tutors felt that even though these non-specialist teachers of chemistry would probably not end up teaching the subject at AS-level, they might well have to teach the subject at key stage 4 and could benefit considerably from access to *Discover LabSkills*.

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<sup>3</sup> It seems that schools are (understandably) protective of their examination cohorts and that the opportunities for trainee teachers to work with them become more circumscribed as the academic year progresses. Getting the resource into circulation earlier in the year should therefore also increase the likelihood of trainee teachers having an opportunity to try it out with AS-level students.

## Guidance on using the resource effectively

Some tutors commented that a teacher's experience had a considerable bearing on the effectiveness with which they made use of resources and that trainee or new teachers, whilst employing it in the classroom, might not fully realise the potential value of Discover LabSkills:

*That is often a 'shortcoming' of many resources – that the resource is good, but the students don't know how to use it effectively*  
(PGCE tutor).

In contrast, experienced teachers, though they might have less need of the resource themselves, would probably be better equipped to use it effectively with students:

*If you're using a resource effectively in the classroom, the chances are that you're an experienced teacher. If they're not too set in their ways, [experienced teachers] might actually make a better hand at using the resource, because they've got more experience of picking up a resource and saying 'I know how I can use it, I know where this'll fit in'*  
(PGCE tutor).

So, in addition to encouraging and supporting PGCE tutors to formally introduce the resource and provide an initial 'pedagogical steer' on its use (see box over page) there may be a case for seeking the support of experienced teachers to develop a repertoire of good practice and associated guidance materials.

In terms of what these guidance materials might usefully cover, responses to the proforma and interview questions suggest that this might include:

- some sort of 'map' of the resource, showing its content and structure, i.e. what to find where;
- help in identifying points in the curriculum where it might be most usefully incorporated into lessons (including taking note of the distinct curricula in Scottish schools)
- examples of where and how it might be employed in a particular lesson, including how the content might be contextualised; and
- ideas on how to use the resource in the classroom, over and above its employment for demonstration purposes.

We understand that there are plans for the University of Bristol to develop exemplar lesson plans using *Discover LabSkills*, with a view to making these available via the *LabSkills* website. This would seem a positive step.

### **Cascading support and guidance: a case for training the trainers?**

Tutor interviewees commented that though they were experienced teachers, they were not all chemists by training themselves, and though the introductory letter which accompanied the first batch of CDs has some useful suggestions, they would welcome more detailed guidance:

*I think if there were clearer guidelines [on how to use and introduce the resource], there would be more chance of lecturers introducing it [properly]*  
(PGCE tutor).

*It would have been useful if the RSC had gathered us together for a training day. Just arriving on our doorstep was probably not the best way of doing it.*  
(PGCE tutor).

We understand that the RSC will be providing more support to tutors over forthcoming academic year, including visiting PGCE tutors who are not chemists by training.

‘Published’ guidance could be produced in the form of ‘old media’ – a booklet – or new media, for example a ‘blog’ on the *Discover LabSkills* website where teachers could share ideas and practice, or a DVD:

*You could have a little DVD that you could produce and I could just show them [trainee teachers] of, you know, maybe other trainees who have used it more successfully. To sort of say ‘I found it useful because...’ a sort of declaration from people about the use that they had made of it that I could use as an introduction*

(PGCE tutor).

**Areas for development: Key points**

- Feedback has been predominantly positive, but nevertheless some areas for development were identified:
  - content: more explicit linkage to the examination syllabi was thought likely to encourage greater usage;
  - presentation: there was substantial support for the provision of an (optional) commentary and sound effects; and
  - access and usage: clarification of when, where and how (with regard to the technicalities of usage) the resource could be employed would be of value.
- There appears to be an association between the receipt of support from their PGCE tutors and trainee teachers' usage of *Discover LabSkills*. Both trainee teachers and their tutors see initial support to access and explore the resource as of value.
- There are some obstacles to tutors providing this support and guidance (contact time, inter-disciplinary tutorial groups and tutors' own professional knowledge), but steps are being taken by the RSC to overcome these (earlier distribution of the CD, provision of sufficient CDs for other trainee teachers where chemists are taught in interdisciplinary groups, and visits to tutors who are not chemists by training).
- Additional guidance materials would be welcomed. As experienced chemistry teachers are believed by some respondents to be better equipped to use the resource effectively, it may be helpful to involve them in the development of practice guides. We understand that there are plans for the University of Bristol to develop exemplar lesson plans using *Discover LabSkills*, with a view to making these available via the *LabSkills* website, and this would seem a positive step.

## 5. Summation and conclusion

This report sets out the primary findings of a contemporaneous evaluation of the first phase of the *Discover LabSkills* project, which saw the distribution of the software for a new ‘dynamic lab manual’ to all (around 550) trainee chemistry teachers in the UK. Approximately one-third of these trainee teachers went on to register with the RSC – a precondition to activating and using their CD – and the evaluation explored how they used the resource, the impacts it was perceived as having, and areas where further development might increase that impact. It draws on data from about 40 per cent of the trainees registering with the RSC, from a handful of trainees who did not, and tutors from around a third of the institutions. This brief final chapter sums up the findings of the study and sets out four ‘key messages’ for consideration going forward.

**Key message 1: Trainee chemistry teachers value having an additional tool which they can use independently to refresh and extend their knowledge and skills**

Many of the trainee teachers contributing to the evaluation openly expressed concerns about either their own subject knowledge, or ability to communicate this to students. Tutors emphasised how little scope there was within the PGCE programme to develop trainees’ subject knowledge and that to a large extent responsibility to address either real or perceived gaps therefore fell on trainee teachers themselves. As a result, many trainees saw *Discover LabSkills* as a valuable tool in their armoury, making use of it to refresh their knowledge and skills and think through how information might be contextualised and communicated.

**Key message 2: Trainee teachers who have made use of the resource believe that it has had a positive impact on their development as practical chemists and teaching professionals, and has potential benefits for the students they teach**

Trainee teachers (and their tutors) saw the resource as impacting positively on their development as teaching professionals. In particular, impacts were identified in relation to: their knowledge and skills; awareness of areas of difficulty and danger; capacity to meet learners’ varying needs; and confidence as practical chemists and chemistry teachers. These outcomes

might be expected, indirectly, to benefit the students with whom trainee teachers come into contact.

Additional impacts may be achieved where *Discover LabSkills* is used directly with students. Though to date this has been attempted by only a few trainee teachers, quite a few more hoped to use the resource in school in the future, and both these trainees and their tutors had given thought to how *Discover LabSkills* might be employed in the classroom, should circumstances allow it.

**Key message 3: The provision of support and guidance around using *Discover LabSkills* appears to encourage trainee teachers to make full use of the resource, and increases the likelihood of them using it effectively.**

One tutor surmised that there will often be obstacles to using a resource such as *Discover LabSkills*, ‘there’s always going to be the logistics, getting access to computers, and there’s always going to be time’, but with a little creative thinking most of these are surmountable, ‘I think that people who want to enrich their students’ understanding, and execution of, practical work will make a space’. The data suggests an association between the provision of support and encouragement and full use of the resource (i.e. with students, in school), and that trainee and new teachers might use the resource more *effectively* in the classroom, if given more comprehensive and ongoing guidance.

**Key message 4: Some additional work to help new teachers surmount routine obstacles (e.g. relating to the availability of appropriate resources) and to use *Discover LabSkills* creatively and effectively may be needed, if maximum impact is to be achieved.**

Whilst the resource itself is seen as valuable, some additional work to help new teachers surmount routine obstacles (e.g. relating to the availability of appropriate resources) and to use *Discover LabSkills* creatively and effectively may be needed, if maximum impact is to be achieved. Though tutors are a key source of support and guidance, not all are themselves chemists by training, and their contact with trainees may be both limited and concentrated at the start of the PGCE year. Providing support and guidance to trainees via their tutors and directly is therefore to be encouraged, and the efforts already underway to do this should be sustained. It might be useful to involve experienced chemistry teachers in the development of guidance materials, or



in testing out the lesson plans which are to be developed by the University of Bristol.

## Appendix

Table A1: 'Q5. Please say to what extent you agree or disagree with the following statements about the *LabSkills* resource'

All responses (n=81) ranked by those strongly agreeing / agreeing

	Strongly agree / agree	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Strongly disagree / disagree	Don't know	Neither / Don't know
It is <i>straightforward</i> to use	<b>57</b>	19	38	6	1	0	<b>1</b>	9	<b>15</b>
It includes <i>appropriate content</i>	<b>56</b>	14	42	5	2	0	<b>2</b>	10	<b>15</b>
It enables you to <i>provide more support to students who are not confident</i> in undertaking practicals	<b>55</b>	16	39	8	1	0	<b>1</b>	9	<b>17</b>
It supports the <i>linkage of theory to practical work</i>	<b>52</b>	11	41	2	0	0	<b>0</b>	10	<b>12</b>
It provides the <i>necessary guidance</i> to explain how it should be used	<b>47</b>	9	38	14	4	0	<b>4</b>	8	<b>22</b>
It enables you to <i>extend the learning of more able students</i>	<b>44</b>	11	33	19	1	0	<b>1</b>	10	<b>29</b>
It enables <i>topics to be covered using practicals which otherwise might not be delivered in this way</i>	<b>42</b>	12	30	21	2	0	<b>2</b>	9	<b>30</b>
It allows <i>more time for discussion</i> around the practical work to aid understanding	<b>40</b>	11	29	20	1	0	<b>1</b>	12	<b>32</b>
It is an <i>invaluable resource</i> for both planning and delivering practical lessons	<b>39</b>	13	26	19	2	1	<b>3</b>	12	<b>31</b>
It enables you to be <i>more ambitious</i> when planning and delivering practical lessons	<b>35</b>	10	25	23	1	0	<b>1</b>	14	<b>49</b>
It helps to <i>maximize the effectiveness</i> of timetabled AS-level practical lessons	<b>34</b>	7	27	22	1	0	<b>1</b>	16	<b>50</b>
It <i>saves you time</i> in preparing for practical lessons	<b>31</b>	8	23	24	2	0	<b>2</b>	16	<b>40</b>
It enables <i>more ground to be covered</i> in AS-level practical lessons	<b>23</b>	8	15	33	1	0	<b>1</b>	16	<b>49</b>
It includes <i>all you need to know</i> to deliver AS practical chemistry	<b>21</b>	7	14	25	10	0	<b>10</b>	18	<b>43</b>

**Table A2: 'Q10. Please say to what extent you agree or disagree with the following statements regarding the impacts of *LabSkills* on you as a teacher'**

**All responses (n=81) ranked by those strongly agreeing / agreeing**

	Strongly agree / agree	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Strongly disagree / disagree	Don't know	Neither / Don't know
It has increased <i>my knowledge</i> of chemistry	<b>44</b>	5	39	14	1	0	<b>1</b>	6	<b>20</b>
It has increased <i>my confidence in demonstrating</i> practical science	<b>43</b>	9	34	12	2	0	<b>2</b>	9	<b>21</b>
It has increased <i>my confidence</i> in running practical sessions with students	<b>42</b>	13	29	14	3	0	<b>3</b>	8	<b>22</b>
It has increased <i>my skills</i> in running practical sessions with students	<b>38</b>	7	31	16	3	0	<b>3</b>	9	<b>25</b>
It has made my lessons <i>more enjoyable and engaging</i> than they otherwise might have been	<b>27</b>	7	20	21	2	0	<b>2</b>	13	<b>34</b>
It has enabled me to deliver a <i>greater variety</i> of practical lessons than I would have been able to deliver otherwise	<b>24</b>	4	20	24	3	0	<b>3</b>	14	<b>38</b>
It has increased <i>the time in lessons that I have been able to spend on doing practical work</i> rather than preparing for it	<b>21</b>	4	17	27	3	0	<b>3</b>	13	<b>40</b>
It has enabled me to deliver a <i>larger number</i> of practical lessons than I would have been able to deliver otherwise	<b>14</b>	4	10	33	3	0	<b>3</b>	15	<b>48</b>

**Table A3: 'Q11. Please say to what extent you agree or disagree with the following statement regard the impact of *LabSkills* on the students you have taught'**

**All responses (n=81) ranked by those strongly agreeing / agreeing**

	Strongly agree / agree	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Strongly disagree / disagree	Don't know	Neither / Don't know
It could ultimately <i>increase students' likelihood of continuing with chemistry</i> in employment and/or higher education	<b>33</b>	16	17	14	2	0	<b>2</b>	16	<b>30</b>
It has contributed to the development of <i>students' practical skills</i>	<b>26</b>	7	19	14	1	0	<b>1</b>	17	<b>31</b>
It has increased <i>students' engagement in practical chemistry</i>	<b>24</b>	5	19	14	2	0	<b>2</b>	16	<b>30</b>
It has developed <i>students' confidence in practical chemistry</i>	<b>22</b>	5	17	18	1	0	<b>1</b>	17	<b>35</b>
It has increased <i>students' engagement in chemistry more generally</i>	<b>21</b>	3	18	18	1	0	<b>1</b>	17	<b>35</b>
It has contributed to the development of <i>students' thinking skills</i>	<b>19</b>	3	16	20	1	0	<b>1</b>	18	<b>38</b>

