Hands-On DNA:
Exploring Evolution

Evaluation Summary Report
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Executive summary

The Hands-on DNA project was a national project led by ASDC which took place between February 2011 and April 2012. The project aimed to select, train and equip 15 new centres across the UK to run highly engaging, practical molecular biology workshops with students age 14-18. The project was delivered in partnership with three organisations with considerable expertise in running innovative DNA programmes, namely At-Bristol, Centre for Life and Nowgen, and funded by the Wellcome Trust.

The Final Project Report for Hands-on DNA, submitted on 25 May 2012 gives the details of the project, the partnerships, and draws together from this report the main evaluation findings and key project outcomes. This report gives the full detail and methodology behind the project evaluation as undertaken by Dr Ben Gammon of Ben Gammon Consulting.

In Summary, 1707 students participated in the project's molecular biology workshops at 15 locations across the UK, accompanied by 176 teachers. Of these, 1514 students and 147 teachers completed evaluation forms which have been analysed as part of this project.

The project team, made up of staff from four organisations, trained and supported 37 staff in 15 'new' organisations to prepare and professionally run one of two molecular biology workshops for students. The entire training programme was evaluated at various points, both from the perspective of the trainees in the 15 organisations and from the project team from the four lead organisations.

Evaluation was by interview and questionnaire and covered the 2-day training academy, the buddy support system and the on-going support by phone and email. In addition the project model was evaluated to assess the value of having ASDC in the project management and national co-ordination role with support from other key organisations.

Overall, the project successfully delivered all of its aims and received exceptionally positive feedback from students, teachers, project partners and the 15 participating organisations. In addition it provided a robust and tested template for future national collaborative projects.

A summary of the key project findings

An overview of the main project outcomes

- In total 845 students and 88 teachers participated in the *A Question of Taste* workshops and 862 students and 88 teachers in the *Bacterial Evolution* workshops.

- Two training academies were run providing training for 37 staff from 15 science and discovery centres, museums and universities from England, Wales, Scotland and Northern Ireland.
- Approximately £80,000 worth of laboratory equipment was provided to the 15 participating centres

Key findings from students

- Feedback from both students and teachers attending the workshops was overwhelmingly positive.
- Students described both the workshops as informative, interesting, enjoyable, fun and thought-provoking.
- Students particularly valued:
    - using high-tech, modern, equipment that works properly
    - learning about molecular biology through hands-on practicals
    - having the opportunity to take part in an extended practical session
    - learning about their own DNA
- 80% of students who attended the A Question of Taste workshop and 91% of those who attended the Bacterial Evolution workshop said that they had not previously had the opportunity to use such scientific equipment before.
- 98% of students felt that the workshop had increased their practical and investigative skills.
- Between 84% and 96% felt that they had increased their knowledge of various aspects of molecular biology: electrophoresis, PCR, restriction enzymes and the genetics of evolution.
- 80% of students who attended the A Question of Taste workshop and 69% of those who attended the Bacterial Evolution workshop felt that it would help them with their subsequent school work.

The key findings from teachers

- Over 90% of the teachers felt that the workshops had increased their students' understanding of molecular biology and evolution and developed students' practical & investigative skills.
- Teachers rated the following as very good: the content of the workshops (92%) the equipment provided (97%) and the staff running the workshops (95%)
- Teachers particularly valued:
    - the quality of the equipment provided for their students
    - the amount and quality of the practical work
    - the support that the workshop was providing for students course work
    - the friendly, helpful, knowledgeable staff running the workshops
    - the way it was organised and run
- 100% of the teachers said that they would recommend the workshops to their colleagues and all but one of them said that they wanted to bring students to future sessions.

Key findings from evaluation of the training academies

- For many centres this was the first time that they had run laboratory-based molecular biology workshops and/or provided events for key stage 4 and sixth form students.
- The two training academies received very positive feedback from the attendees who particularly valued:
    - the opportunity to learn about and practise the set-up and running of the workshop
    - meet with their Buddies and fellow workshop leaders
    - learning about the background science to the workshops
- Four-fifths of the attendees felt that the academies had increased their understanding of molecular biology and evolution, as well as their ability to explain these areas of science to other people
- Over three-quarters of the attendees felt more confident about their ability to run the workshops after the academy and nobody left feeling less confident
- Recommendations from participants for improving future *Hands-On DNA* two-day training academies included:
    - providing extra time to practise setting-up and running the workshop
    - more information/time on the areas of the workshop covering evolution
    - more time to learn about the dialogue activity
    - more advice and examples of good practice in marketing to schools

Key finding from evaluation of the support system: ASDC and Buddies

- There was universal praise for the Buddies and the role that they played in this project. Many workshop leaders said that without the buddy support system they would not have been able to deliver this project.
- The ASDC team and the Buddies provided a wide range of support reflecting the widely differing needs of different centres:
    - Running practise sessions of the workshop
    - Trouble-shooting difficulties with the equipment and reagents
    - Assisting centres to purchase consumables
    - Chasing-up late deliveries
    - Helping to develop marketing strategies
    - Advice on engaging teenage students
- The support provided by ASDC and the Buddies was particularly crucial in the period between the end of the training academies and the running of the first few workshops
- Most of this support was provided via email or phone as well as personal visits to the participating centres
- ASDC was felt to have played a crucial role in supporting the work of the Buddies, organising the ordering of equipment and co-ordinating the evaluation of the project as well as generally raising the profile of the project nationwide.

- The involvement of ASDC was also seen as crucial for recruiting and nurturing centres that had no previous experience of running molecular biology events for schools
- Very little use was made during the project of the Google Group and the Twitter account, with participants preferring to speak direct to an expert in the project team

Staff at participating centres also mentioned the following benefits for their centres:

- The opportunity to network with other science engagement professionals and develop new working relationships
- Their increased practical skills, scientific knowledge and confidence
- The ability to use the workshop to promote their collections and exhibitions
- Using the project to raise the profile of their centre among local schools and in the local media
- The opportunity to maintain or increase the number of visits from secondary schools
- The generation of new ideas for events for schools and families

Evaluation related to centre's sustaining the workshop after the project

- At the end of the project, 100% of the centres were keen to continue running the workshops
- Factors that participants felt would be important for ensuring the continuation of the workshops included:
    - ensuring that centres have a system in place and the necessary materials to train new staff
- The most frequently cited threats to the continued running of the workshops were:
    - The cost of the consumables
    - The cost of the staff-time to set-up, run and clear-up the workshops
    - Competition for staff-time and events space with other funded programmes
    - Schools choosing cheaper educational events
    - Competition from neighbouring centres and universities offering similar workshops for free
    - Limited pool of trained staff in the centre to draw upon

1. Introduction to the Evaluation

This report describes the findings from the evaluation of the ASDC-led *Hands-On DNA: Exploring Evolution* project. This comprises of the *A Question of Taste* (QoT) workshop and the *Bacterial Evolution* (BE) workshop as well as the training academies and Buddy support system used to train and support staff from the 15 participating centres. It includes feedback from students and teachers who attended the workshops, staff at participating centres who ran them, and staff at the partner organisations (the Buddies) who provided support on behalf of ASDC.

1.1 Background of the project

In 2009 three UK science and discovery centres collaboratively pioneered a new molecular biology workshop for post-16 students. This workshop, known as 'A Question of Taste', gives students the opportunity to take part in a full day hands-on workshop. They first test their taste reaction to a bitter chemical (similar to one found in sprouts) and then isolate their DNA to discover if they have a corresponding gene coding for the relevant taste receptor. Students then explore the evolutionary story behind the differences in tasting within populations, and participate in a dialogue activity with their peers.

The creation and delivery of these pioneering workshops was funded by the Wellcome Trust as part of Darwin 200 Celebrations. The project partners were Nowgen in Manchester, At-Bristol and Centre for Life in Newcastle. Overall the workshops have been a huge success and these three centres will continue to run these workshops in the future.

In 2007 ASDC discussed with the Wellcome Trust our shared vision that students in all parts of the UK should have the opportunity to take part in high-quality molecular biology workshops, and experience firsthand the techniques used in modern bioscience.

In 2010 the Wellcome Trust approached ASDC to solicit a proposal to look at a phase 2 for 'A Question of Taste'. This aimed to make these high-level 'A Question of Taste' workshops accessible to students in a broader variety of UK locations, and to explore what could be achieved nationally to engage students with the power and delight of molecular techniques.

The proposal was accepted, and in May 2011 the *Hands-on DNA: Exploring Evolution* project began led by ASDC in partnership with At-Bristol, Centre for Life and Nowgen working to provide molecular biology workshops to secondary school students across the UK.

The specific aims of the project were to:

- Enable students across the UK to use cutting edge equipment and the latest molecular biology techniques to explore evolution and their own DNA
- Embed molecular biology into the school programmes of informal learning organisations across the UK

The project provided training, equipment, marketing materials and on-going support for staff at 15 centres in England, Wales, Scotland and Northern Ireland, enabling them each to run one of two workshops for visiting school groups.

The first workshop was a consolidated QoT workshop, which took in to account the experiences of the three main partners who had been delivering it previously. The second, Bacterial Evolution, was developed as part of this project to act as a starter workshop for centres with little or no molecular biology provision, to build confidence and expertise in these centres.

Additional support was provided by way of a 'Buddy system', whereby each of the three main partners was paired with five new participating organisations. The Buddies then visited each of these at least once to support set-up, planning and delivery of their first workshop. They also acted as a first port of call for all enquiries regarding the workshop.

In return for this support each organisation agreed to market and run one of the workshops at least five times, for approximately 100 students, between October 2011 and April 2012.

1.2 Evaluation aims and objectives

Ben Gammon Consulting was contracted by ASDC to undertake the evaluation of the *Hands-On DNA* project, which sought to assess the reactions of students and teachers to the workshops and the immediate impact upon students. Additionally it aimed to assess the mechanism used to plan and deliver this project and identify lessons for future UK-wide collaborative projects.

The evaluation of *Hands-On DNA* covered four aspects of the project:

I. Students' feelings about, and learning from the workshops
II. Teachers' feelings about the value of the workshops
III. The opinion of staff and managers at the 15 participating centres about the project and its long-term impact
IV. The opinion of the four partner organisations about the project and its long-term impact

I - Students participating in the workshops

This evaluation sought to assess:

- Whether students had previously had the opportunity to undertake this type of practical work in school
- What new knowledge about evolutionary biology they gained or reinforced
- What skills – practical and thinking skills - the students were able to develop
- To what extent the students found the workshop inspiring and interesting, and whether it had increased their self-confidence
- How they felt the workshop could be improved

II – Teachers bringing groups to the workshops

- What knowledge and skills they believe their students gained or reinforced
- Whether the workshop provided something that they had not previously been able to do in school
- How they felt the workshop could be improved
- Whether the workshop provided value for money
- Their likelihood of bring students to future sessions of these workshops and of recommending them to other teachers, and reasons for doing so or not doing so
- How teachers had found out about the workshop

Additionally each participating organisation recorded the number of workshops run, and how many students and teachers attended each session.

III – Staff trained to run the workshops

- What they gained from the training academy that they attended
- How it could be improved
- The support provided by ASDC and the Buddies
- The quality of the workshop itself – ease of running, reactions of students and teachers, how it could be improved
- The extent to which they feel the project has delivered the ASDC mission and the *Hands-On DNA* project objectives
- The factors that would facilitate or inhibit the future running of the workshop after the end of the project
- Their plans for the future provision of the workshop

IV – Buddies

- The buddy's assessment of the challenges faced by the participating centres and the effectiveness of the support they and ASDC provided
- Useful lessons for future collaborative projects among ASDC members
- Factors that they believe would facilitate or inhibit the on-going running of the workshop after the end of the project
- The extent to which they feel the project has delivered the ASDC mission and *Hands-On DNA* project objectives

2. Methodology

Ben Gammon Consulting was contracted by ASDC to undertake the analysis of the evaluation. The overall framework for the evaluation was co-developed between ASDC and Ben Gammon Consulting. ASDC worked with the centres to ensure the appropriate use of the student and teacher questionnaires, and compilation of the results. Ben Gammon Consulting undertook the interviewing of project participants and Buddies, as well as the analysis of the data from the student and teacher questionnaires.

Four methods were used to gather information about the *Hands-On DNA* project:

1. analysis of bookings data
2. email questionnaires
3. telephone interviews
4. self-completion questionnaires.

2.1 Analysis of bookings data

Staff at the 15 participating centres recorded the number of workshops run during the project, the number of schools who booked places as well as counting the number of students and teachers who participated.

2.2 Teacher and student self-completion questionnaires

All staff and teachers who attended Hands-on DNA workshops were asked to complete paper questionnaires at the end of each session.

In total 787 students and 78 teachers completed questionnaires about the A *Question of Taste* workshop; 727 students and 69 teachers completed questionnaires about from the Bacterial Evolution workshop.

2.3 Two-day training academy self-completion questionnaire

At the end of each training academy attendees were asked to complete a paper questionnaire. In total 38 questionnaires were completed.

2.4 Training academy follow-up email questionnaire

Two to three weeks after the academy all attendees were sent a short questionnaire by email about the longer-term impact of the training as well as their hopes and concerns regarding the forthcoming workshops.

2.5 Buddies telephone interview

At the end of February 2012 all of the Buddies were interviewed by telephone about their experience of supporting the staff at the participating centres. Interviews lasted between 10 to 15 minutes and used a semi-structured questionnaire.

2.6 Workshop leaders telephone interviews

At the end of March 2012 one workshop leader from each of the 15 participating centres was interviewed by telephone about their experience of running the workshops and of the Buddy support system. Interviews lasted between 10 to 15 minutes and used a semi-structured questionnaire.

2.7 Response rate

1,707 students participated in Hands-On DNA workshop of which 1,514 completed a questionnaire; a response rate of 89%. 176 teachers attended Hands-On DNA workshops, of which 147 completed questionnaires; a response rate of 84%.

2.8 Data tables

Data in some tables sums to slightly more or less than 100% due to percentage figures being rounded to one decimal place.

3. Findings part 1: The training academies

3.1 The training academies

Immediately after each of the training academies attendees were asked to complete a short questionnaire. The results from the two academies are reported separately below.

3.1.1 *Question of Taste* academy

The 18 attendees gave an overwhelming positive overall rating to the *A Question of Taste* (QoT) academy (Table 1).

Very positive ratings were given consistently to the organisation of the academy, the team running the academy and the venue. None of the attendees gave any aspect of the QoT academy a rating below 3 out of 7. 95% of responses were in the top two ratings on a seven-point scale.

The handbook received the least positive rating although it was unclear from attendees' feedback forms why this was so.

Table 1: Attendees' assessment of the QoT academy

n = 18	**Very good 1**	**2**	**3**	**4**	**5**	**6**	**Very Poor 7**
Overall assessment	12	5	0	0	0	0	0
Organisation of the academy	12	6	0	0	0	0	0
The handbook	6	7	4	1	0	0	0
The content of the sessions	10	7	1	0	0	0	0
The team running the academy	15	3	0	0	0	0	0
The venue for the academy	14	4	0	0	0	0	0

"Very good, great way of doing the course. Excited to do this now!"

"I found it all very useful, well organised and enjoyable too"

"Best workshop/short course I've attended in years!"

Attendees identified the following aspects of the QoT academy as being particularly beneficial:

- The practical sessions practising how to set-up and run the workshop – 13/18
- Talking to others with more experience and expertise of running the workshop – 6/18
- Information about the science behind the workshop – 5/18
- Meeting staff from other participating centres – 4/18
- Meeting the Buddies – 3/18
- Health and safety information – 1/18

Attendees liked the mixture of presentations and practical workshops providing both hands-on experience and time for reflection and discussion.

> *"So well balanced with lab and class sessions with good timings and sequence"*

The QoT academy received very positive ratings. When asked on the questionnaire how they would improve it, the following suggestions were given:

- The dialogue activity was confusing/ too rushed – 5/18
- Problems dealing with differing levels of knowledge among academy attendees – 3/18
- Would have been more useful to run workshop in real time – 2/18
- Handbook was difficult to navigate/match to presentation – 2/18
- A lot of content to take in – 2/18

Academy attendees were asked to rate the success of the QoT academy in achieving certain key learning outcomes (Table 2).

The majority of attendees rated the academy as very or quite successful across all of the learning outcomes, although "Increasing your knowledge of the theory of evolution" and "Increasing your confidence to explain concepts of evolution" received lower ratings (as was the case with the *Bacterial Evolution* academy – see Table 4 below).

Table 2: QoT academy's success in achieving key learning outcomes

n = 18	Very successful	Quite successful	Not very successful	Not at all successful	% very or quite successful
A. Increasing your understanding of relevant areas in molecular biology	11	5	0	0	100%
B. Increasing your confidence to demonstrate molecular biology equipment	12	5	1	0	94%
C. Increasing your confidence to explain PCR, restriction digests and electrophoresis	10	7	1	0	94%
D. Providing you with the necessary information about the practicalities of setting up and running this workshop	14	4	0	0	100%
E. Increasing your knowledge of the theory of evolution relevant to this workshop	8	9	1	0	94%
F. Increasing your confidence to explain concepts of evolution relevant to the workshop	9	8	1	0	94%
G. Increasing your confidence in marketing this workshop	8	10	0	0	100%
H. Answering your questions about this workshop	13	5	0	0	100%
I. Providing an opportunity to network with other *Hands-On DNA* participants	16	2	0	0	100%

At the end of the QoT academy attendees were asked to rate its impact upon their overall level of confidence about running the workshop. Of the 18 attendees, 16 said that it had increased their confidence, while two said their level of confidence was 'about the same'. None of the attendees felt less confident about running the workshops.

The Buddy system was of considerable importance with many attendees praising this approach and expressing how much they would be relying upon them.

> *"A huge amount covered - but still quite daunted - Buddy system will be very important!"*

> *"Will look forward to the two Buddy visits; they are going to be essential to giving the confidence to deliver competently"*

3.1.2 *Bacterial Evolution* academy

As with the first academy the 20 attendees at the *Bacterial Evolution* (BE) academy were extremely positive about the experience. 95% of academy attendees rated every element of the academy as 1 or 2 on a seven-point scale. None of the attendees gave a rating below 4 to any aspect of the academy and only one person allocated a rating of 3 (Table 3).

Table 3: Attendees' assessment of the BE academy

n = 20	**Very good 1**	**2**	**3**	**4**	**5**	**6**	**Very Poor 7**	**% rating 1 or 2**
Overall rating	18	2	0	0	0	0	0	100%
Organisation of the academy	18	2	0	0	0	0	0	100%
The handbook	16	3	1	0	0	0	0	95%
The content of the sessions	13	7	0	0	0	0	0	100%
The team running the academy	19	1	0	0	0	0	0	100%
The venue for the academy	19	1	0	0	0	0	0	100%

> *"As a complete novice I was concerned I would not be able to keep up. Everyone was very supportive and took time to explain/clarify things for me. An excelling training session"*
>
> *"Fantastic - many thanks!"*
>
> *"Congratulations on running a well organised academy for bacterial evolution - can't wait to starting rolling it out"*

As with the QoT academy the organisation of the BE academy and the staff running it were all given universally positive ratings.

Attendees identified the most valuable aspects of the BE academy as:

- Practical sessions practising how to set-up & run the workshop – 13/20
- Talking to others with more experience & expertise of running the workshop – 5/20
- Information on background science – 2/20
- Tips and Q&A sessions with the team – 2/20
- The reflection session – 1/20
- Presentation hand-outs and worksheets – 1/20

The BE academy received very positive ratings. When asked how it might be improved, the following suggestions were given: notably around wanting more time practicing the set-up and running of the workshop.

- Not enough time to practice set-up / running of workshop – 7/20
- Marketing session unnecessary – 5/20
- Dealing with teenagers session unnecessary – 3/20
- Need a 'further reading' list – 3/20
- Not enough on the background science – 3/20
- Bacterial evolution game was confusing – 2/20
- Need more on how to handle teenagers – 1/20
- Need a list of consumables & approximate costs – 1/20
- Equipment used in training not the same as that provided for workshop – 1/20
- Need more about the safe disposal of consumables - 1/20

Academy attendees were asked to rate the success of the BE academy in achieving certain key learning outcomes (Table 4).

Over three quarters of attendees felt that the academy had been successful in achieving all of its learning outcomes although attendees were gave slightly lower ratings about the practicalities of setting up and running the workshops and the information about evolution.

Table 4: BE academy's success in achieving key learning outcomes

n = 20	**Very successful**	**Quite successful**	**Not very successful**	**Not at all successful**	**% of very or quite successful**
A. Increasing your understanding of relevant areas in molecular biology	16	4	0	0	100%
B. Increasing your confidence to demonstrate molecular biology equipment	11	8	1	0	95%
C. Increasing your confidence to explain restriction digests and electrophoresis	10	10	0	0	100%
D. Providing you with the necessary information about the practicalities of setting up and running this workshop	10	7	3	0	85%
E. Increasing your knowledge of the theory of evolution relevant to this workshop	6	11	3	0	85%
F. Increasing your confidence to explain concepts of evolution relevant to the workshop	6	11	3	0	85%
G. Increasing your confidence in marketing this workshop	8	9	3	0	85%
H. answering your questions about this workshop	13	7	0	0	100%
I. Providing an opportunity to network with other *Hands-On DNA* participants	18	2	0	0	100%

At the end of the BE academy participants were asked to rate its impact upon their level of confidence about running the workshop. 18 said that their confidence had increased, 2 that it was the same as before the workshop. None of the participants felt less confident after the training academy. As with the QoT academy attendees recognised the vital role of the Buddies.

> *"A lot of information to take in over 2 days, however ongoing "Buddy" support should allow us to effectively deliver the workshop"*

> *"It's very reassuring to have the Buddy system in place"*

3.2 Participants' expectations for the project

2-4 weeks after they had returned from the training academies staff from the participating centres were sent a short email questionnaire seeking to assess their hopes and concerns about the project prior to actually running the workshops.

Responses were sent in confidence to the independent evaluator. Three reminder emails were sent to ensure that a sufficient response rate was achieved. A total of 20 responses were received from staff at 13 of the 15 participating centres.

3.2.1 Perceived challenges

All of the participants were excited about running the workshops. For many it would be the first time that they had run molecular biology and/or laboratory-based workshops, while for others presenting to key stage 4 students would be a new experience.

Prior to their first Buddy visit, participants identified a wide range of challenges that they felt would need to be overcome (Table 5). These varied considerably from one organisation to another depending on the space they had to run the event, and their previous experience of running similar events for secondary school audiences.

Preparing the workshops and operating the equipment were two major areas of concern. This was also reflected in the help that participants expected from ASDC and their Buddy (Table 6). Another area of concern for some participants was the lack of any purpose built laboratory space within their organisation.

Several participants were also concerned about whether teachers would book such a long workshop and the lack of an education pack to send out to schools to promote the workshops in advance.

Table 5: Anticipated challenges

Challenges identified	**No. of respondents n = 20**
Will schools book?	
Will schools book a 5 hour workshop?	6
No teachers' pack to send out	5
Short time to market workshops to schools before project ends	4
Will schools book at the cost we charge	3
Can only run workshop for one class at a time	2
Competition from other school events we offer	1
Suggested marketing strategies too expensive	1
Setting-up the workshop	
Staff time required to prepare for workshops	7
Getting the equipment in time	5
Doing the prep work correctly – not ruining the experiments	4
Cost of consumables & extra equipment required	4
Time to practice & perfect workshop	1
No space for prep work	1
Sourcing consumables	1
Admin – H&S, accessibility documentation	1
Running the workshops	
Finding & using space to run workshop	9
Limited prior knowledge of molecular biology among presenters	2
Keeping to time during workshop	2
Lack of storage space for equipment	2
No technician available to help run workshop	2
Availability of staff to run workshops	1
Coordinating with partner organisation	1
Using different equipment to that used in training academy	1
Engaging & maintaining teenagers interest	1
Sustaining workshop	
How to train additional staff to run future workshops	1

Staff from the participating centres were asked what specific help they were hoping to receive from their Buddy, and ASDC. Their responses are shown below in Table 6.

Assistance with the preparation and setting up of the workshops was the most frequently mentioned request along with quick trouble-shooting advice on using the equipment via phone or email.

Table 6: Expected help from ASDC & Buddy organisation

Assistance sought	**No. of respondents n = 20**
Advice / assistance preparing & setting up workshop	9
Quick response / troubling shooting re: equipment, materials, operations	8
Buddy organisation to help with running of 1st workshop	6
Chance to watch Buddy organisation running workshop	4
Advice on using non-ideal spaces for workshop – i.e. no bespoke laboratories	2
Advice on how to contact teachers/ market to schools	2
Advice on presentation skills	1
Up-to-date information on genetics	1
ASDC to facilitate networking among participating centres	1
ASDC to provide briefing on select committee report on school practicals	1

Participants were very pleased with the information provided by ASDC at the academies especially the images and information about the background science. Suggestions for improvements included: using a more eye-catching logo; providing advice on how to market to schools and providing template marketing materials for centres that do not already have them.

3.2.2 Expected benefits for visitors

Participants identified a wide range of benefits they hoped students and their teachers would gain from attending the workshops (Table 7)

Participants frequently mentioned the importance of authenticity in their responses to this question – the chance to do real experiments using high-tech equipment, in a real laboratory setting; the opportunity to meet real scientists and science undergraduates.

Table 7: Hoped for benefits for workshop audiences

Expected benefits for students & teachers	No. of respondents n = 20
Opportunity to use equipment not normally available in school	14
Learn laboratory techniques & science process skills	11
Raise awareness of the real world application of molecular biology	10
Increased knowledge of molecular biology/support classroom teaching	9
Conduct real experiments in laboratory setting	8
Increase interest in molecular biology/genetics	7
Raise students' interest in science careers or post 16 courses	6
Chance to meet real scientists / science undergraduates	4
Gain a sense of achievement/exciting	3
Increase awareness of the importance of molecular biology in science	1
Provide teachers with ideas of things to do in school	1
Chance for teachers to see students working in different environment	1

3.2.3 Expected benefits for the participating centres

Staff from participating centres were also asked about the benefits that they personally hoped to gain from the *Hands-On DNA* project. Participants mentioned developing their background knowledge and skills so that they could develop new molecular biology workshops after the end of the project.

Table 8: Expected benefits for participating centres

Expected benefits for participating centres	No. of respondents n = 20
Skills, knowledge & confidence to run molecular biology workshops	11
Increase my knowledge of molecular biology	10
Ability to develop new molecular biology workshops in future	6
Develop experience & skills of working with key stage 4 students	3
Develop working relationships with other science centres	2
Training opportunities for other members of the learning team	2
Incorporate molecular biology workshop into schools programme	3
Improved relationships with schools	2
Improved relationships with local university	1
Experience of working on a large collaborative project	1

4. Findings part 2: Feedback from the Buddies

Five Buddies from the partner organisations were interviewed by phone during February and March 2012, after they had completed at least one visit to the centres that they were supporting.

4.1 Challenges faced by the participating centres

All of the Buddies felt that the project had been a challenging but very worthwhile experience and that the support system had worked extremely well.

The Buddies identified a range of challenges faced by the participating centres running the workshops. The help that they needed from the Buddies varied widely depending upon the size of the centres, their previous experience of running biomedical workshops and of catering for secondary school groups. The short time frame for acquiring the necessary equipment, consumables and for recruiting schools was also often mentioned.

Other challenges that the Buddies identified were:

- Lack of staff experience in dealing with difficult teenage students
- Running workshops in spaces that were not designed for laboratory style activities
- The need for more practise in setting up and running the workshop
- Problems with trial sets of reagents provided by the supplier not being appropriate
- Contacting suppliers about the late arrival of additional equipment or consumables
- Ensuring that centres purchased correct consumables – for example one centre purchased from an off-list supplier and as a result obtained the wrong DNA stain; another ordered the wrong size of Eppendorf tubes

The Buddies themselves experienced some difficulties making site visits to the centres they were supporting. In part this was because of the distance they had to travel but also in some cases difficulties arranging suitable dates for their site visits within the time available.

Several of the Buddies also mentioned the difficulties of communicating with the rest of the core team. The restricted time-scale of the project and the wide geographical spread of the partner organisations meant that there was limited opportunity for the core team to meet in person. Conference calls were not found to be an effective alternative especially as staff time had not been allocated in the budget for these calls.

4.2 Help provided by Buddies

Buddies provided a great deal of support for the participating centres without which many would not have been able to deliver the workshops. This support included

- Advice on where to buy consumables and what to purchase
- Help the project manager to chase-up late arriving equipment

- Trouble-shooting problems with operating equipment, preparing reagents, setting up and running the workshop – e.g. use of the DNA stain
- Interpreting the protocols for the workshop and the background material – reinforcing what had been learnt at the academies
- Running practise sessions of the workshop
- Developing a fees structure for the workshop
- Advice on selling workshops to schools – how to market; how to sell, whom to approach
- Strategies for engaging teenagers and coping with difficult students

Although Buddies provided an enormous amount of technical advice they also felt that simply providing reassurance and boosting confidence was often as important.

Attracting Key Stage 4 school groups was a major challenge for some centres although not for others. This seemed to depend upon the centres' past experience of attracting secondary school groups. Those that already had such experience were able to draw upon their existing contacts with teachers to sell the workshops. Buddies felt that this is an area where expertise among centres could usefully be shared.

Most of this support was provided via phone, email and to a lesser extent by personal visits to the centre. Very little use was made of the Google Group and of Twitter although most tried. It seems that social media was not well suited to the sort of one to one contact that was required.

Various reasons were suggested for this including: the extra effort required to log-on to a discussion forum; competition from other on-line discussion groups; that the workshop leaders were often not the people who regularly Tweeted on behalf of the centre; and that there were just not enough people within the Google Group to generating interesting and regularly changing discussions.

However several of the Buddies believed that the Google Group would prove to be much more useful *after* the end of the project, helping centres to continue running the workshops. One Buddy recommended 'seeding' the Google Group and Twitter account with interesting content at regular intervals to encourage participants to contribute.

The Buddies felt that the most important period for providing support to the participating centres was between the end of the training academies and the running of the first few workshops. Most contact seemed to occur when the participating centres first received the laboratory equipment and were beginning to order the consumables. Buddies also tried to be on hand when the first workshop was run.

4.3 Embedding the workshops in the centres' practice

Buddies were asked what they believed would facilitate or hinder the on-going running of the workshops after the end of the project. All of them felt that the centres wanted to continue running these workshops although there were challenges which would need to be overcome.

On-going support from ASDC and the Buddies *after* the end of the project, through personal contacts and the Google Group, will they felt, be crucial to maintaining the confidence, knowledge and skills of staff at the centres.

Centres that already have staff with biomedical training and/or have a lower turnover of personnel should find it easier to continue running the workshops than those where there is a constant influx of new staff requiring training. Ensuring that centres have efficient systems for passing on the necessary knowledge and skills will be especially important.

The ability of centres to modify the workshops to meet the needs of different audiences and to more closely link to their exhibitions was also felt to be important.

Buddies believed that the clear curriculum relevance and the high quality of the experience provided should ensure that these workshops can be sold to schools provided that they are effectively marketed. The fact that the location of centres running the workshops has been carefully selected to avoid them competing with each other or with other organisations was felt to be particularly helpful in this respect.

The Buddies identified a range of potential barriers to this goal being achieved. The need to recover the cost of consumables was felt the most significant challenge by all of the Buddies. Whether schools would be willing to pay enough to cover these costs is not yet clear. Exacerbating this problem might, it was felt, be the competition for staff-time, space and school audiences from other, cheaper educational events provided by the centres.

4.4 Role of the ASDC

The Buddies all felt that ASDC had played a key role in the project coordinating the work of the partner organisations and recruiting participant centres through their extensive network of contacts. ASDC's role in ordering equipment was particularly appreciated as it freed up the Buddies' time to support the staff at participating centres.

ASDC's knowledge about the needs of science centres and how they run school workshops was also felt to have been hugely valuable for this project. By being slightly removed from the day to day running of the workshops ASDC was able to provide a useful oversight of both the participating centres and the Buddies. While another organisation might have been able to take on these roles it was felt that they would have found it much more difficult.

ASDC's involvement was felt to have increased the likelihood of centres joining the project, especially those that had little or no previous experience of running molecular biology workshops.

Negotiating the relationship between the partners, agreeing their roles and areas of responsibility required tact and careful planning. While ASDC had the advantage of being a neutral organisation, it also had to ensure that different centres' areas of expertise were recognised and drawn upon, ensuring that appropriate compromises were struck between the somewhat differing approaches of the centres.

4.5 Lessons learnt for future projects

Buddies were asked what lessons should be drawn from their experience of *Hands-On DNA* to shape future collaborative projects among science and discovery centres.

- The model of training academies, Buddy support system and a central coordinating organisation managing the procurement of equipment is extremely effective in providing tailored support for a wide range of centres with widely differing needs
- Purchasing and delivery of equipment and consumables is very time-consuming and care needs to be taken to ensure that the correct materials are ordered
- Time should be built into collaborative projects to ensure that the needs of individual centres can be properly assessed
- Complex, collaborative projects involving many partners require that roles and responsibilities are agreed from the very beginning to ensure that best use is made of existing knowledge and experience
- A neutral party leading the project is advantageous as it avoids the impression that one centre is trying to impose its working practices on others. Decisive leadership of the project is vital for its success
- Project planning must include how widely separated partners will communicate and make decisions
- It is vital to ensure there is enough time in the project programme for face-to-face meetings since conference calls and social media are not very effective in building working relationships
- For projects aiming to attract secondary schools the programme needs to be carefully aligned to the academic year. Teachers often want to book workshops several months in advance and there is very limited time for out of school trips because of the pressure of exams
- Project planning also needs to take into account that centres will be running other projects in parallel

5. Findings part 3: Feedback from workshop leaders

Phone interviews were conducted during March 2012 with workshop leaders from each of the 15 organisations. All interviewees had run at least one session with students.

Workshop leaders were asked about their experience of the project since the end of the training academy, their thoughts about the sustainability of the workshop programme after the end of the project, and their recommendations for future collaborative projects.

5.1 Overview

The overall impression from all the workshop leaders was that *Hands-On DNA* was a challenging but extremely worthwhile project. Different centres faced very different problems but the training academies and the Buddy support system had both been very effective in tackling them. There was a great deal of appreciation for the work of ASDC in organising and coordinating the project.

5.2 Benefits achieved

All of the workshop leaders were very complimentary about the workshops and the experience they had provided for the students and teachers. Many mentioned the value of students doing real scientific experiments with high quality equipment and gaining results that were of personal relevance to them.

> *"Really well received by teachers and students … every student we've work with got a result of some sort so that was a real success"*
>
> *"Teachers were just over the moon with the day"*
>
> *"It was really good to do a really different type of workshop to what we normally do"*

In addition, workshop leaders were able to identify a wide range of benefits that both their centre and they personally had gained from participating in the project:

- Opportunity to network with science communicators from other centres and develop new working relationships
- Increased practical skills, scientific knowledge and confidence
- Ability to use the workshop to promote their collections and exhibitions
- Raised profile for their centre among schools and in the local media
- Maintained or increased the number of visits from secondary schools
- New ideas for events that could run for schools and families

5.3 Challenges faced

Although most of the centres encountered some difficulties during the project all felt that the effort they and others had put into it had been worthwhile. Several workshop leaders specifically said that the problems they could identify were minor compared to the benefits gained by students, teachers, the centres and their staff.

The difficulties encountered varied widely between different centres depending their previous experience of: running molecular biology workshops, working with secondary schools, and whether they had access to other sources of support such as university departments.

Obtaining consumables – reagents and disposal equipment - and the staff-time required to set-up, run and clear-up each workshop were the most frequently mentioned challenges. For some of the centres recruiting secondary schools was also found to be somewhat challenging.

5.3.1 Obtaining Consumables

Several of the workshop leaders reported difficulties obtaining reagents and disposal equipment from the suppliers because of:

- The time required to set-up accounts with the suppliers
- The time required for the supplies to be delivered
- Difficulties of ensuring that they were ordering exactly the right kind of materials

> *"Some of [the suppliers] were quite slow about getting things arranged. Some of them wanted detailed information about what we were going to use the equipment for"*

Delays in obtaining these materials meant that some of the centres had little time to run practise sessions, and a shorter period in which to meet the target for school attendance.

The help provided by the Buddies, ASDC and local universities proved to be invaluable in overcoming these problems. Some centres were even able to borrow equipment and consumable from local university departments.

5.3.2 Workshop preparation

The staff time required to prepare and run the workshop was much greater than for other events the centres offer schools. Although all of the centres were able to set-up and run the workshops some felt that they needed two or even three staff to do so.

> *"It needs a lot of preparation sort of ten times what would be needed for standard workshops"*

Concerns were sometimes raised about the long-term sustainability of the workshops given the cost of the staff-time they require.

Some of the centres found that working with PhD students and scientists from their neighbouring university was very effective in overcoming these difficulties. The PhD students and scientists were able to help prepare and run the workshops and as an added bonus were able to talk to the school groups about their research.

> *"[The PhD students] sorted out all the gels for us because they know exactly what is needed … they've been an absolute God-send"*

5.3.3 Recruiting schools

Some of the centres experienced difficulties recruiting key stage 4 schools for the workshop, in part because of the project coinciding with school holidays and exams. However other centres had little or no difficulty often because they were recruiting schools. These centres already had established relationships with secondary schools and/or were able to subsidise their travel cost and the workshop.

Other approaches found to be successful in recruiting schools were:

- Offering the workshop as part of a larger package of activities e.g. another workshop or a tour of the centre
- Promoting the workshop at teacher training events
- Providing free taster sessions of the workshop for visiting teachers

5.3.4 Managing teenage students

Some of the workshop leaders reported difficulties managing student behaviour during the workshop. This mostly related to holding their attention during the presentation about the background science and while students were waiting for equipment to become available or gels to run.

On two occasions workshop leaders found that they were presenting to extremely challenging groups – in one instance a group from a referral centre and another a group with learning difficulties. Although these were very difficult sessions to run in both cases the workshop leaders were able to successfully engage the students and the teachers were delighted with what had been provided for them.

Workshop leaders' suggestions for tackling these problems included:

- Providing more equipment so that students do not have to wait for it to become available
- Providing activities for students to do while they waited for experiments to run or equipment to become available
- Revising the timetable for the BE workshop to introduce a short break for key stage 4 students
- Changing the balance of practical activities to presentation so that the workshop is less like a school lesson

5.3.5 Time available for the project

Although all of the centres were able to run the workshops for schools several felt that the time available was very tight especially since the programme for the project included the Christmas and February half-term holidays leaving no contingency in the programme for late arrival of equipment and consumables, school exam or schools cancelling bookings.

5.3.6 Other challenges

Other difficulties encountered by workshop leaders were:

- Running the workshop in events spaces that were not purpose built laboratories – e.g. lacking running water, storage space for reagents and equipment etc
- Demonstrating techniques to 20-30 students at a time – difficulty ensuring that students could properly see what was happening
- Limited pool of trained staff and volunteers to draw upon to prepare and run the workshops

5.4 Workshop leaders' feedback on the support system

5.4.1 The Buddies

There was universal praise for the Buddies and the support they had provided. For many of the centres the Buddies were a vital bridge between the training academy and the first workshops. Workshop leaders were particularly valued being able to obtain quick replies by phone or email to their queries.

The Buddies were able to tailor their support to match the particular needs of each centre. Different centres clearly required different kinds of support depending on their past experience of running molecular biology workshops. While some wanted helped with how to communicate science to teenagers others needed more practical assistance with the setting up and running of the workshops or chasing up orders for equipment and reagents.

5.4.2 ASDC

The contribution of the ASDC team was widely praised by workshop leaders especially their role in ordering the equipment and chasing-up late deliveries, arranging the training academies, coordinating the work of the Buddies, providing an additional source of information and coordinating the evaluation process.

The UK wide remit of the ASDC was also felt to be a great asset when helping to raising the profile of *Hands-On DNA* among schools and for encouraging organisations that had no previous experience of running biology themed workshops to join the project.

> *"No one else brings all the science centres together under one umbrella"*
>
> *"Without the ASDC, we would not have been able to run these workshops as we did not have the equipment, knowledge or skills to do so"*
>
> *"If it wasn't for the ASDC I don't think my centre would have been involved in this project"*

5.5 Sustaining the workshops after the project

Workshop leaders were asked to identify factors that would facilitate, and those that might hinder, their centre running these workshops after the end of the project.

The most frequently mentioned challenges to the long-term running of the workshops were:

- Covering the cost of consumables – reagents and disposal equipment
- Covering the cost of the staff needed to prepare, run and clean-up the workshops
- Competition for events space, staff-time and school groups from other, cheaper events
- Competition from neighbouring centres and universities offering similar workshops for free or from schools being able to run similar activities for themselves
- Limited pool of trained staff to draw upon

The staff time and resources required to run the BE and QoT workshops is considerably greater than for other, less complex school events. Although everyone felt that the workshops are high quality products they were concerned that to teachers they may appear expensive compared to other events on offer.

Centres were either concerned that teachers would be unwilling to pay a sufficiently high fee to cover these overheads or else have a policy of not charging for school events so are entirely dependent upon their operational budgets.

Despite these difficulties all of the workshop leaders said that their centres planned to continue offering the workshop after the end of the project. Factors identified as greatly facilitating the long-term running of the workshops were:

- The quality of the workshop
- The very positive response from teachers
- The legacy of equipment and training resources provided by ASDC
- The network of science communicators established by the project
- The enthusiasm of the staff running the workshop
- That the workshop can easily be modified to meet the particular needs of the centre or to appeal to a wider audience

Several of the workshop leaders said that they were considering focusing their future marketing efforts on sixth form groups where they believed there would be greater demand than from key stage 4 groups.

Workshop leaders were asked what they would purchase to help sustain the workshops if an additional £4,000 was available. They mentioned

- Stocking-up on consumables - reagents and disposal equipment
- Purchase more equipment - PCR machine, an extra UV illuminator, more gel electrophoresis tanks, more vortex machines
- Cover costs of extra staff to run workshops
- Subsidise transport costs for schools
- Provide better quality resources for teachers to take back to school
- Train more staff to run the workshops
- Modify the workshop to relate more to their collections and exhibitions

5.6 Lessons for future projects

From their experience of the *Hands-On DNA* project workshop leaders provided the following suggestions for future collaborative projects. In many cases the recommendations refer to aspects of the *Hands-On DNA* project that workshop leaders had found to be particularly successful.

- Use the model of a central coordinating organisation, training academies and Buddies providing support via phone, email and personal visits
- The training academies should take account of the very different needs of different centres – some will require help with presenting the science others with setting-up and running the workshop
- Ensure that maximum use is made of the expertise among partner organisations – e.g. previous experience of running these workshops or working with secondary schools
- Project plans need to be flexible enough take account of the very different constraints and working procedures of the different participating centres
- Include university departments as project partners to provide workshop staff, reagents, equipment and technical support as well as opportunities to talk about careers and real research
- Identify suppliers for all equipment and consumables in advance and agree orders and prices at the start of the project. Bulk purchase consumables to reduce costs and use more than one supplier to avoid overwhelming them with orders
- The project programme needs to take account of time required to: order, deliver and check equipment and consumables; practice the workshop and recruit schools. Build in some contingency time in the programme for unexpected difficulties outside the control of the project team e.g. problems with suppliers or schools cancelling bookings
- Ensure that participating organisations have all of the equipment and consumables prior to the academy so that they can start practicing the workshop immediately after the training
- Test run the workshop with groups that you already know well and are comfortable working with
- Consider offering the BE workshop as part of a package of events so that it can be a full day's outing for schools
- Ensure that all participating organisation have understood the targets that they are required to meet and exactly what they are required to provide at the start of the project. Even this information is written in the contracts and training documents participants may not notice it
- Ensure that the project programme takes account of 'down-time' when schools are not able or willing to visit
- Ensure that the workshop is easy to adapt to meet changing demands from schools, appeal to slightly older or younger audiences and to align with the centre's collections

6. Findings part 4 – feedback from students

In total 845 students attended the QoT workshop and 862 the BE workshop. Of these:

- 787 students completed questionnaires about the QoT workshop
- 727 about the BE workshop

No major differences were observed in the feedback from the two workshops.

6.1 Students' reactions to the workshops

Students were asked to select from a list words and phrases that they felt best described the workshop that they had just taken (see Table 9). The majority of students felt that the QoT workshop was informative, interesting, enjoyable and fun.

The most commonly selected critical term was 'confusing', chosen by 7.2% of the students. Just 0.2% of students *only* selected negative descriptors of the QoT workshop while 11.2% selected a mixture of positive and negative terms – often 'interesting' and/or 'informative' with 'confusing' or 'frustrating'.

Table 9: Students' reactions to Question of Taste

n = 787					
Informative	88.1%	Rewarding	22.9%	Confusing	7.2%
Interesting	87.0%	Inspiring	22.2%	Frustrating	2.2%
Enjoyable	66.2%			Dull	1.9%
Fun	53.6%			Boring	1.7%
Thought-provoking	43.3%			Uninteresting	0.9%

Students' reactions to the BE workshop were almost identical with the majority finding it: interesting, informative, enjoyable and fun (Table 10). Just 1.3% *only* chose negative descriptors while 17.1% chose a mixture of negative and positive terms – again mostly 'interesting', 'informative', 'enjoyable' along with 'confusing' or 'frustrating'. The most frequently selected negative descriptors were as for the QoT workshop confusing and frustrating.

Table 10: Students' reactions to Bacterial Evolution

n = 727					
Interesting	84.6%	Inspiring	31.9%	Confusing	10.5%
Informative	76.8%	Rewarding	24.1%	Frustrating	5.5%
Enjoyable	65.1%			Boring	5.1%
Fun	52.5%			Dull	4.3%
Thought-provoking	34.3%			Uninteresting	1.1%

Students were asked what in particular they liked about the workshops. Students who attended the QoT workshop mentioned:

- Using high quality scientific equipment that is not available to them in school; especially the micropipettes, the gel electrophoresis equipment, UV illuminator, PCR machine – 39%
- The quality and amount of the practical activities; the experience of doing real laboratory work – 30%
- Seeing the end result; learning about your own genotype and phenotype – 22%
- Learning about the science behind the techniques; about the genetics of evolution; quality of the explanations provided – 5%
- That it helps with their current school studies – 2%
- Exploring the museum/centre – 2%
- Chance to work independently and be trusted – 1%
- Improving their practical lab skills – 1%

Students who had participated in the BE workshop mentioned a very similar list of attributes:

- Using high quality scientific equipment that is not available to them in school; especially the micropipettes, the gel electrophoresis equipment, UV illuminator, vortex machine – 50%
- The quality and amount of the practical activities; the experience of doing real laboratory work; that it was not just listening to someone – 28%
- Seeing the results on the UV illuminator – 13%
- Learning about the science behind evolution, bacteria and disease diagnosis – 6%
- Overall laboratory experience; wearing gloves, white coat, goggles – 3%
- That it helps with their current school studies – 1%
- Chance to work independently and be trusted – 1%
- Helpful, friendly staff – 1%

Students in both workshops particularly enjoyed learning how to use the micro-pipettes, loading the electrophoresis gels, and seeing the visualisation of the DNA bands under UV light.

Students were asked to compare the workshop to their experience of science lessons and practicals at school. Overwhelming the comparison was favourable towards the workshop with more than 90% commenting on the better quality and more reliable equipment, the much greater amount of practical work vs. listening, reading and writing. Many of the students mentioned that they do little or no practical work in school.

Students also commented on: the more in-depth information; more challenging activities; the benefits of having much more time to complete the activity; better facilitation and the friendly relaxed and professional environment. Some of the younger students taking the BE workshop also mentioned the novelty of wearing a lab coat, gloves and goggles.

- More practical activities, less listening, reading & writing – 43%
- Better, more advanced, more reliable equipment – 40%
- More in-depth information – 5%
- Longer duration for practical activities – 4%
- More challenging activities – 4%
- More friendly, relaxed, professional environment – 3%
- Better facilitators – 3%

Example quotes from students

"I liked using the micro-pipettes because it felt like CSI"

"The end when we saw the results, it was very rewarding"

"The part where they turned off the lights and it went UV. Why? Because UV light is pretty awesome!"

"Using the really precise pipettes"

"Gel electrophoresis in action because we only learnt about it theory wise"

"It was more adult and advanced than school"

"We don't get to do that many practical lessons. Also we don't get gloves and coats - which was a bonus"

"We don't get to do that many practicals especially in biology"

"I have a chance to learn from experience not just from notes and textbooks"

"The practicals at school are really unreliable and almost never work - it was refreshing to be able to do one properly"

"Using equipment that works, unlike school"

"To be able to prove my dislike of sprouts to genetics"

"A good reason not to eat sprouts! Very interesting to see how genes actually work"

"Being able to find out about your own genes makes it more interesting"

"Being able to sequence DNA with complex equipment like a real scientist"

Students were also asked how they felt the workshop could be improved. Often the suggested improvements involved extending what is already provided e.g. more practical work, or more activities to do while waiting for the gels to run.

42% of the students from the QoT workshop could not suggest any improvements, many saying that it was already very good. The most frequently suggested improvements to the QoT workshop were:

- More practical activities and less presentations/discussion – 8%
- Shorter / faster paced workshop – 6%
- More / longer breaks within the workshop – 6%
- Less waiting around for experiments to run – 5%
- Clearer instructions / better presentation / better AV – 3%
- More time to look around the centre / museum – 3%
- Test a wider range of genes – 2%
- More background information on evolution, genetics, how the equipment works – 2%
- Written instructions and background information students can take away – 2%
- Not including the paper cutting (restriction enzyme) activity – 2%

38% of the students who attended the BE workshop could not suggest any improvements, many of them stating that it was already very good. As with the QoT workshop the most frequently suggested improvements were:

- More practical activities and less presentations/discussion – 16%
- More / longer breaks within the workshop – 9%
- Longer workshop – 8%
- More background information about the experiments, bacteria, disease – 6%
- Better presentation e.g. more AV – 3%
- Larger venue / less crowded – 3%
- Clearer instructions – 2%
- Less waiting around for experiments to run – 1%
- Written instructions and background information students can take away – 1%
- More equipment so do not have to share / wait – 1%

"It can't be improved it was amazing"

"I can't think of any. It was simply the best"

"More activities and less talking and writing"

"Less talking more doing"

"Things to do while waiting for electrophoresis"

6.2 Evidence of learning - **Question of Taste workshop**

Of the 787 students who completed the QoT questionnaire:

- 80.1% had never previously used this sort of equipment in school (18.7% had occasionally and 0.8% had often used this sort of equipment in school)
- 79.7% felt that the workshop would help them with their subsequent school work (17.6% were unsure; 2.3% said that it would not) 80.0% felt that it made them think that working in science might be interesting (15% were unsure and 5% felt that it had not done so)

Students were asked to rate the success of each workshop in achieving certain key learning outcomes (Table 11). Over 90% of the students from the QoT workshop felt that it was very or quite successful in increasing: their understanding of polymerase chain reactions, restriction enzymes, electrophoresis and human evolution; developing their investigative and practical skills; as well as increasing their confidence and interest in science.

The QoT workshop seemed to have been particularly successful in developing students' practical skills (75.8% felt that it was very successful in this respect). It appeared to be least successful in increasing students' understanding of evolution although even here 35% felt it was very successful and 56% quite successful.

Table 11: How successful do you feel the QoT workshop was in achieving the following aims?

n = 787	**Very successful**	**Quite successful**	**Not very successful**	**Not at all successful**	**% of very or quite successful**
Increasing or reinforcing your understanding of how PCR (polymerase chain reaction) works?	55.5%	42.5%	1.8%	0.1%	98.0%
Increasing or reinforcing your understanding of how restriction enzymes work?	40.9%	55.4%	3.6%	0.1%	96.3%
Increasing or reinforcing your understanding of how electrophoresis works?	48.9%	43.8%	6.9%	0.4%	92.7%
Increasing or reinforcing your understanding of human evolution?	34.8%	55.8%	8.7%	0.8%	90.6%
Providing an opportunity to develop your investigative skills	59.4%	37.7%	2.8%	0.1%	97.1%
Providing an opportunity to develop your practical skills	75.8%	23.2%	0.8%	0.3%	99.0%
Increasing your confidence in your ability to understand this area of science?	50.6%	45.6%	3.5%	0.3%	96.2%
Increasing your interest in science?	47.1%	46.0%	5.7%	1.2%	93.1%

38.3% of the students were *more* interested in studying science after attending the QoT workshop while 53.0% said that they were already interested prior to the workshop. Just 8.3% were disinterested in science both before and after the workshop, and 0.4% were less interested having taken the workshop.

6.3 Evidence of learning - *Bacterial Evolution* workshop

Of the 727 students who completed the BE questionnaire:

- 90.6% had never previously used this sort of equipment in school (8.7% had occasionally and 0.7% had often used this sort of equipment in school)
- 69.2% felt that the workshop would help them with their subsequent school work (27.2% were unsure; 3.6% said that it would not)

- 73.9% felt that it made them think that working in science might be interesting (17.5%% were unsure and 8.6% felt that it had not done so)

Over 90% of the students from the BE workshop felt that it was very or quite successful in: increasing their understanding of restriction enzymes, and bacterial evolution; developing their investigative and practical skills; and increasing their confidence and interest in science (see Table 12). The lowest average rating was for 'increasing or reinforcing your understanding of electrophoresis but even here 31% felt that the workshop had been very successful and 53% quite successful.

As with the QoT workshop the BE workshop was particularly successful in developing students practical skills with 73.1% stating that it was very successful in this respect.

Table 12: How successful do you feel the BE workshop was in achieving the following aims?

n = 727	**Very successful**	**Quite successful**	**Not very successful**	**Not at all successful**	**% of very or quite successful**
Increasing or reinforcing your understanding of how restriction enzymes work?	40.0%	56.0%	3.5%	0.6%	96%
Increasing or reinforcing your understanding of how electrophoresis works?	30.8%	53.4%	13.5%	2.3%	84.2%
Increasing or reinforcing your understanding of bacterial evolution?	41.9%	50.6%	6.8%	0.7%	92.5%
Providing an opportunity to develop your investigative skills	59.1%	38.1%	2.6%	0.1%	97.2%
Providing an opportunity to develop your practical skills	73.1%	25.0%	1.7%	0.3%	98.1%
Increasing your confidence in your ability to understand this area of science?	48.3%	46.5%	4.3%	0.8%	94.8%
Increasing your interest in science?	44.2%	45.1%	8.3%	2.4%	89.3%

After attending the BE workshop 47.3% of the students were more interested in studying science while 42.3% said that they were already interested prior to attending the workshop. Just 9.4% said that they were not interested in studying science before or after the workshop and 1.0% that they were now less interested.

7. Findings part 5 – feedback from teachers

In total 88 teachers attended the QoT workshop and 88 the BE workshop. Of these:

- 78 teachers completed a questionnaire about the QoT workshop
- 69 teachers completed a questionnaire about the BE workshop

Teachers were asked how they had found out about the workshop; their responses are shown below in Table 13. Most had been found out through personal contact from someone at the centre.

Table 13: How teachers found out about the workshop

Marketing channel	**% of teachers n = 147**
Personally contacted by someone from the centre	31%
Leaflet/letter sent to your school	19%
Word-of-mouth recommendation from colleague	14%
Centre website	11%
STEMNET	6%
Email message sent to school	3%
Found out when visiting centre with school or on CPD	3%
Student Award Night	2%
Careers Wales	1%

(Combined data from BE & QoT workshops)

7.1 Teachers' reactions to the Question of Taste workshop

Teachers' rating of the QoT workshop was extremely positive. Over 85% rated the content, equipment, staff, venue and quality as very good (Table 14). None of them rated any aspect of the workshop as poor or very poor.

Table 14: Teachers' reactions to the QoT workshop

n = 78	Very Good	Good	Poor	Very Poor	% good or very good
The content of the workshop	96%	4%	0%	0%	100%
The equipment provided	97%	3%	0%	0%	100%
The knowledge of staff running the workshop	95%	5%	0%	0%	100%
The venue of the workshop	85%	15%	0%	0%	100%
Overall, how would you rate the workshop	95%	5%	0%	0%	100%

When asked what they particularly liked about the QoT workshop they mentioned:

- The amount and quality of the practical work – 32%
- The quality of the equipment provided / opportunity to use equipment not normally available to schools – 26%
- That the workshop was well organise; good pacing and balance of theory, discussion and practical activities – 26%
- There was a close fit to what students are learning in class – 21%
- Good, clear explanations of complex concepts – 19%
- It brought classroom science to life by showing link to real world applications; making abstract concepts real – 13%
- That students could study their own DNA – 9%
- The friendly, helpful, knowledgeable staff running the workshop – 7%
- Experience of a real laboratory - 6%
- The link to the museum collections – 4%
- The restriction enzyme activity – 4%
- That it would inspire students future career and course choices – 3%
- The thought-provoking content and challenging activities - 3%
- The discussion sections where students can express their ideas and ask questions – 2%
- That students can work independently on the practical activities – 1%
- Development of practical laboratory skills – 1%

"Using modern equipment that we would not otherwise get the opportunity to experience - fab!"

"Clearly explained, built on AS knowledge, we could never do a practical like this at school students thoroughly enjoyed it"

"Students were able to get hands-on experience of practicals only talked about in class"

“Experiencing work in a "real" lab good preparation for uni”

“The quality of the equipment made the workshop excellent in terms of practical skills also more inspiring for the students. Also so relevant to the syllabus”

When asked how the QoT workshop could be improved teachers suggested:

- Providing more information – mostly more about evolution but also sickle cell anaemia and comparing plant to animal DNA – 14%
- More discussion / Q&A activities where students can express opinions and ask questions – 10%
- More open-ended investigative activities that do not have a pre-determined result – 4%
- Larger / more comfortable venue – 6%
- Clearer link to the museum collections – 4%
- Have pre-prepared electrophoresis gels to show students what they should look like – 3%
- Provide worksheet or written resource that students can take away – 3%
- More time for the workshop – 3%
- Modify to appeal to older educational groups – 3%
- Make afternoon session shorter – 1%
- Make the morning session shorter – 1%
- Make the gel loading activity quicker – 1%
- Include an ice-breaker activity at the beginning – 1%
- Include a break part way through – 1%

“Structure discussions and thinking tasks to ensure all students have an opportunity to engage”

“Questioning via 30 second table discussion followed by selecting tables for answering out loud to encourage them to speak out”

“Our students usually come from a Higher Human Biology background as have very little knowledge of evolution, so they needed more grounding in that area to get the maximum out of that section”

Of the teachers who had paid to bring a group of students to the QoT workshop 97% felt that it was value for money. Just two teachers felt that the price they paid was slightly too high.

When asked if they would recommend the QoT workshop to other teachers every one of them said that they would do so. Likewise all of the teachers said that they would like to bring students to future sessions of the QoT workshop.

97% of the teachers felt that the workshop had inspired their students while over 80% felt that it had encouraged them to continue studying science and to consider a

career in science (Table 15). Of these outcomes teachers seemed least certain about whether the workshop would encourage students to consider a career in science but even here 80% believed that the workshop was successful at least to some extent in this regard.

Table 15: Teachers' assessment of the QoT workshop's impact on students' attitudes

n = 78	**Strongly agree**	**Agree**	**Neither agree / disagree**	**Disagree**	**Strongly disagree**	**% agree or strongly agree**
I feel today's workshop will have inspired my students	54%	44%	3%	0%	0%	97%
I feel today's workshop will have made them more likely to consider a career in science	29%	51%	17%	3%	0%	80%
Access to more workshops like this would increase students' motivation to study science	76%	23%	1%	0%	0%	99%

Teachers were asked to rate the success of the QoT workshop in achieving key learning outcomes.

Over 90% of the teachers felt that the workshop was very or quite successful in: increasing students understanding of molecular biology techniques and the concepts of evolution; developing their practical and investigative skills as well as providing an opportunity to use advance laboratory equipment (Table 16).

Of these learning outcomes teachers seemed least sure about the impact upon their students' understanding of evolution and developing their investigative skills. Even so 94% and 99% respectively felt that the workshop was successful to at least some respect in these terms.

Table 16: Teachers' assessment of the educational impact of the QoT workshop

n = 78	Very successful	Quite successful	Not very successful	Not at all successful	% very or quite successful
Increasing or reinforcing your students' understanding of molecular biology techniques?	86%	13%	1%	0%	99%
Increasing or reinforcing your students' understanding of concepts in evolution?	32%	62%	4%	0%	94%
Providing an opportunity to use molecular biology equipment?	94%	4%	3%	0%	97%
Providing an opportunity for your students to develop their investigative skills?	50%	49%	1%	0%	99%
I feel today's workshop developed my students' hands-on practical skills	83%	17%	0%	0%	100%

7.2 Teachers' reactions to the Bacterial Evolution workshop

Teachers rating of the BE workshop was extremely positive with all of them rating the content, equipment, staff, venue and overall quality as very good or good. No teacher rated any aspect of the workshop as poor or very poor (Table 17).

Table 17: Teachers' reactions to the BE workshop

n = 69	Very Good	Good	Poor	Very Poor	% very good and good
The content of the workshop	88%	12%	0%	0%	100%
The equipment provided	96%	4%	0%	0%	100%
The knowledge of staff running the workshop	94%	6%	0%	0%	100%
The venue of the workshop	67%	33%	0%	0%	100%
Overall, how would you rate the workshop	81%	18%	0%	0%	100%

When teachers were asked what they particularly liked about the BE workshop they mentioned:

- The quality of the equipment provided / opportunity to use equipment not normally available to schools – 41%
- The amount and quality of the practical work – 39%
- That the workshop was well organised with clear and simple instructions, good quality AV – 13%
- That it would inspire students future career and course choices – 12%
- The friendly, helpful, knowledgeable staff running the workshop – 10%
- That it brought classroom science to life by showing link to real world applications – 9%
- That students can work independently on the practical activities – 4%
- There is a close fit to what students are learning in class – 4%
- The thought-provoking and challenging content - 4%
- The restriction enzyme activity – 3%

"Good chance to use expensive equipment and good for pupils to wear lab coats!"

"The feeling of using "proper" equipment and techniques"

"Fantastic for enthusing the pupils to consider biology at A level and beyond"

"Fantastic opportunity for students to see the sort of work done in biomedical labs"

Teachers were also asked how the BE workshop could be improved. Teachers provided a range of suggestions mostly extending aspects of the existing workshop and providing more background information.

- Provide more background information about DNA, evolution, bacteria, application of genetics to forensics – 16%
- More time for the workshop – 10%

- Offer to a wider range of ages / adapt workshop so that it is accessible to a wider age range – 9%
- Better venue; darker, more comfortable, larger, less distractions, a proper laboratory – 7%
- Provide written instructions for the activity and background information that students can take back to school – 4%
- Incorporate short breaks to help students focus – 4%
- Include more discussion activities where students can express their ideas – 3%
- More open-ended investigative activities that do not have a pre-determined result – 2%
- Include an ice-breaker activity at the beginning – 2%

"There wasn't much on evolution to meet these aims"

"Clearer link to evolution of bacteria"

"Show an educational video that explains DNA in more detail and the experiments that they are doing. An explanation of how this science can be used in everyday life e.g. solving crime"

Of the teachers who had paid to bring a group of students to the BE workshop 99% felt that it was value for money. Just one teacher felt that it was slightly too expensive while another felt that it was only value for money if the travel costs were subsidised.

When asked if they would recommend the BE workshop to other teachers All of them said that they would do so. Likewise all but one of the 69 teachers said that they would like to bring students to future sessions of the BE workshop. Just two teachers mentioned the cost of the workshop as a potential barrier to them booking future sessions.

Over 85% of the teachers believed that BE workshop had inspired their students, encouraged them to continue studying science and consider a career in science (Table 18).

Of these outcomes teachers seemed least certain about whether the workshop would encourage students to consider a career in science. Nonetheless 85% of the teachers still believed that the workshop was successful at least to some extent in this regard.

Table 18: Teachers' assessment of the BE workshop's impact on students' attitudes

n = 69	**Strongly agree**	**Agree**	**Neither agree / disagree**	**Disagree**	**Strongly disagree**	**% strongly agree or agree**
I feel today's workshop will have inspired my students	51%	49%	0%	0%	0%	100%
I feel today's workshop will have made them more likely to consider a career in science	46%	39%	15%	0%	0%	85%
Access to more workshops like this would increase students' motivation to study science	84%	16%	0%	0%	0%	100%

Teachers were asked to rate the success of the BE workshop in achieving key learning outcomes. Over 90% of the teachers felt that the workshop was very or quite successful in: increasing students understanding of molecular biology techniques and the concepts of evolution; developing their practical and investigative skills as well as providing an opportunity to use advance laboratory equipment (Table 19).

As with the QoT workshop teachers seemed least certain about the impact upon their students' understanding of evolution and developing their investigative skills. Even so 91% and 99% respectively felt that the BE workshop was successful to at least some respect in these terms.

Table 19: Teachers' assessment of the educational impact of the BE workshop

n = 69	**Very successful**	**Quite successful**	**Not very successful**	**Not at all successful**	**% very successful or quite successful**
Increasing or reinforcing your students' understanding of molecular biology techniques?	61%	38%	1%	0%	99%
Increasing or reinforcing your students' understanding of concepts in evolution?	33%	58%	9%	0%	91%
Providing an opportunity to use molecular biology equipment?	93%	7%	0%	0%	100%
Providing an opportunity for your students to develop their investigative skills?	57%	42%	1%	0%	99%
I feel today's workshop developed my students' hands-on practical skills	81%	19%	0%	0%	100%

8 Conclusions

The *Hands-On DNA* project has delivered all of its goals, on time and budget. The project has demonstrably increased the capacity of UK science centres to deliver high quality molecular biology workshops to secondary school audiences. The legacy of equipment, skills, knowledge, motivated staff and the support network should ensure that these workshops continue to form a major part of these centres educational programming.

Additionally important lessons have been learned about running UK wide, multi-site collaborative projects. The model of training academies and supporting Buddies coordinated by a central organisation with the UK-wide remit has been shown to be highly effective.

The project has shown the importance of providing bespoke training, support and resources that are tailored to the widely varying needs of different centres. It has also shown the advantages of having a central organisation with a UK wide remit to recruit centres to the project, coordinate the training and support network, the purchasing of equipment and supplies, and the project evaluation process.

Additionally, this project has shown the value of centres linking-up with university departments who can provide additional equipment, consumables and technical assistance, as well as illustrating the real world applications of the techniques being featured.

The most critical elements on the critical path of the project were identified as obtaining equipment and consumables and recruiting secondary schools. Similar projects in future need to ensure that there is sufficient time available for these activities, and seek to align the programme to the academic year.

Compared to other types of school event molecular biology laboratory workshops are considerably more expensive in terms of the costs of consumables and the staff-time required to set-up, run and clear-up. Despite the obvious demand for such workshops from teachers it is vital that appropriate resources continue to be allocated to marketing them to schools and efforts made to reduce the costs of the consumables.

Half and one day laboratory-based molecular biology workshops clearly have an enormous appeal to, and benefit, for secondary school students and their teachers. In particular, the provision of high tech, up-to-date equipment allows for a much higher quality of practical work than can be achieved in the vast majority of schools. Such workshops provide an opportunity for students to experience first-hand scientific concepts and techniques that they have previously only read about or seen demonstrated.

Feedback from students as well as their teachers shows that these workshops increase their knowledge, practical skills, self-confidence and interest in science.

Appendix – Evaluation tools

Student questionnaire

We would like to find out what you thought of today's workshop so that we can improve our future programmes.

Please complete this form and return it to a member of staff. Many thanks.

1. What year are you in? .....
2. Are you male or female? .....
3. **Circle** the words below that best describe your feelings about today's workshop *(choose as many words as you like).*

Fun	**Boring**	**Informative**
Inspiring	**Rewarding**	**Uninteresting**
Interesting	**Confusing**	**Enjoyable**
Dull	**Thought-provoking**	**Frustrating**

4. What did you like most about the workshop and what in particular did you like about it?

5. How do you think this workshop could be improved?

6. In what ways, if any, this workshop different from the science practicals you do in school?

7. How successful do you feel the workshop was in achieving the following aims?

	Very successful	Quite successful	Not very successful	Not at all successful
Increasing or reinforcing your understanding of how restriction enzymes work?				
Increasing or reinforcing your understanding of how electrophoresis works?				
Increasing or reinforcing your understanding of bacterial evolution?				
Providing an opportunity to develop your investigative skills				
Providing an opportunity to develop your practical skills				
Increasing your confidence in your ability to understand this area of science?				
Increasing your interest in science?				

8. Have you used this type of equipment before at your school?
   Yes often ☐ Yes occasionally ☐ No never ☐

9. Do you think your experience today will help you with school science classes?
   Yes ☐ No ☐ Not sure ☐

10. Did your experience today make you think that working in science might be interesting?
    Yes ☐ No ☐ Not sure ☐

11. Did the workshop today make you feel... (tick only one option)
    ☐ More interested in studying science
    ☐ The same, I already wanted to study science
    ☐ The same, I don't want to study science
    ☐ Less interested in studying science

12. Were the instructions you were given today clear?
    ☐Yes all of them ☐ Some of them ☐No none of them

13. Any other comments?

That's all. Thank you for your time. Please return this questionnaire to a member of staff.

Teacher questionnaire

We would like to find out what you thought of today's workshop so that we can improve our future programmes. Please complete this form & return it to a member of staff. Thank you for your assistance.

1. Which year group(s) of students have you brought today?.....

2. How would you rate the following aspects of today's workshop?

	Very good	Good	Poor	Very Poor
The content of the workshop				
The equipment provided				
The knowledge of staff running the workshop				
The venue of the workshop				
Overall, how would you rate the workshop				

3. What did you particularly like about today's workshop?

4. What impact do you feel the workshop had on your students?

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
I feel today's workshop will have inspired my students					
I feel today's workshop developed my students' hands-on practical skills					
I feel today's workshop will have made them more likely to consider a career in science					
Access to more workshops like this would increase students' motivation to study science					

5. How successful do you feel this workshop was in achieving the following aims?

	Very successful	Quite successful	Not very successful	Not at all successful
Increasing or reinforcing your students' understanding of molecular biology techniques?				
Increasing or reinforcing your students' understanding of concepts in evolution?				
Providing an opportunity to use molecular biology equipment?				
Providing an opportunity for your students to develop their investigative skills?				

6. What changes could we make to this workshop to increases its chances of achieving these aims?

7. Would you recommend this workshop to other teachers?
   Yes ☐ No ☐

7b. {If no} why would you **not** recommend this workshop to other teachers?

8. Would you bring students to this workshop next year?
   Yes ☐ No ☐

8b. {If no} For what reasons would you **not** bring students next year?

9. Do you feel that this workshop was good value for money?
   Yes ☐ No, slightly too expensive ☐ No, too expensive ☐

10. How did you hear about this workshop (tick all that apply)?

- ☐ Leaflet/letter sent to your school
- ☐ Personally contacted by someone from this centre
- ☐ Word-of-mouth recommendation from colleague
- ☐ Through STEMNET
- ☐ Centre website
- ☐ Other website {please specify} …….
- ☐ Other {please specify} .....

11. How many students were there in the group you took with you today?

Thank you for your time. Your feedback will help us develop better schools workshops in the future and improve this one. Please hand your completed questionnaire to a member of staff

Training Academy feedback questionnaire

We would like to find out what you think about the training academy. This will be used as part of our evaluation of the project. Answers are anonymous so please be frank in your feedback. When completed please fold this form and return it to a project team member. Thank you for your assistance.

1. How do you rate the overall quality of the academy (please circle)?

Very good	**Good**	**Poor**	**Very Poor**

2. Please rate the following aspects of the academy:

	Very good						**Very Poor**
	1	**2**	**3**	**4**	**5**	**6**	**7**
Organisation of the academy							
The materials provided							
The content of the sessions							
The team running the academy							
The venue for the academy							

3. Which part(s) of the academy did you find **most** useful? What in particular did you find useful?

4. Which part(s) of the academy did you find **least** useful? What could be done to improve that part(s) of the course?

5. Please rate how successful you feel the academy has been in achieving the follow:

	Very successful						**Not at all successful**
	1	**2**	**3**	**4**	**5**	**6**	**7**
Increasing your understanding of relevant areas in molecular biology							
Increasing your confidence to demonstrate molecular biology equipment							
Increasing your confidence to explain PCR, restriction digests and electrophoresis							
Providing you with the necessary information about the practicalities of setting up and running this workshop							
Increasing your knowledge of the theory of evolution relevant to this workshop							
Increasing your confidence to explain these concepts of evolution							
Increasing your confidence in marketing this workshop							
Answering your questions about this workshop							
Providing an opportunity to network with other Hands-on DNA participants							

6. Thinking of how you felt **before** the academy, has your confidence to deliver molecular biology workshops:

☐ Increased	☐ About the same	☐ Decreased

7. What is the highest level to which you have studied biology in formal education

☐ O level / GCSE	☐ A level or equivalent	☐ BSc or equivalent
☐ PhD		

8. Prior to the academy how would you rate your level of knowledge of molecular biology?

☐ Low	☐ Medium	☐ High

Training Academy follow-up email questionnaire

Dear Academy participants,
As the independent evaluator for the Hands-On DNA project I would like to gather, in confidence, your thoughts about it is currently progressing. I've listed below 8 questions that I would appreciate your thoughts on. Please send me your responses by Wed 16th November.

If anything is unclear please feel free to contact me on the above email address. All responses will be treated as confidential and will not be attributed to any individual or organisation in the final report.

1. What specific assistance are you hoping to obtain from ASDC and your 'Buddy' organisation during the project? What if any have you already received?

2. How do you feel about the marketing materials and teachers resources provided for this project? What are their strengths and weaknesses? How could they be improved?

3. By the end of this project what are you personally hoping to have gained? Any specific skills, knowledge, experience?

4. What benefits do you hope that your visitors will gain from these workshops - both the students and their teachers?

5. What do you feel are the biggest challenges to achieving these objectives? What are the major risks that could undermine the success of this project for you, your organisation, your visitors?

6. What aspects of the Hands-On DNA project are you most excited about?

7. What aspects of the project are you most concerned about?

8. Any other concerns, questions or suggestions about the Hands-On DNA project?

Many thanks for your assistance

Buddies telephone interview

1. What help did you provide the organisations you supported?
    - E.g. help with equipment, laboratory set-up, preparing workshops, running workshops, communicating with teenagers, working with teachers, recruiting schools

2. When did they need this assistance?
    - Between the training academy and the first workshop, after the first workshop, later on?

3. How did you provide this assistance?
    - In person, by phone, by mail, via the Internet?
    - Which methods do you find most and least effective?

4. Were you able to provide all of the assistance that was requested? If not, for what reasons were you unable to provide that?

5. What do you feel was the most valuable assistance you provided?

6. How likely is it that the organisations you supported will continue to run these workshops after the end of the project?
    - What do you feel might help them keep the workshops running?
    - What might prevent them from doing so?

7. What do you feel were the benefits of ASDC leading this project?
    - What do you feel was their most valuable contribution?
    - Was this something that could have been provided by one of the science centres instead?
    - How successful do you feel this project has been in achieving ASDC's objective of "Bringing together the ASDC membership to play a strategic role in the nation's engagement with science"?

8. What lessons do you feel we can learn from your experience to help us develop future collaborative projects like this one?
    - If we ran this project again what would you do differently?
    - What advice would you give to another 'buddy' working on this project?

9. Do you feel that ASDC should lead future collaborative projects like this one? If so what role should ASDC play in such projects?

Workshop leaders' telephone interview

1. What was your overall experience of running the workshops?

2. How did the students and teachers' respond to the workshop?

3. What benefits did you, your colleagues and your organisation gained from participating in this project?

4. What problems did you encounter during the project?
   - E.g. with recruiting schools, learning how to use the equipment, finding suitable laboratory space, preparing the reagents, running the workshop?

5. What help did you receive from your Buddies and ASDC?

6. How did you receive that assistance – in person, by phone, mail, via the Internet? Which was the most effective methods of communication?

7. What was the most valuable assistance that they provided for you?

8. When did you need that assistance?
   - Immediately after the training academy
   - Between the training academy & the first workshop
   - After the first workshop

9. What do you feel were the benefits of ASDC leading this project?
   - What do you feel was their most valuable contribution?
   - Was this something that could have been provided by one of the science centres instead?

10. What role should ASDC play in future collaborative projects?

11. What might hinder your organisation continuing to run the Hands-On DNA workshops beyond the end of the project?

12. What may help your organisation to keep running the workshops beyond the end of the project?

13. If an extra £4,000 were available now for spending on this project what would you spend it on?

14. What lessons do you feel we can learn from your experience to help us develop future collaborative projects like this one?
   - If we ran this project again what would you do differently?
   - What advice would you give to another 'buddy' working on this project?