



Evaluation of the Optoelectronics College

Final Report

for

Optoelectronics College and Rank Prize Fund

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Evaluation of the Optoelectronics College

by

Donna James and Clare Lambley

of

James Lambley & Associates

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The responsibility for the content of this report rests with James Lambley & Associates.

James Lambley & Associates

Ivy House
Maunby
North Yorkshire
YO7 4HD

Unit 5A, West View
Littlethorpe
North Yorkshire
HG4 3LN

Tel: 01845 587479

Email: jameslambley@outlook.com

Reg. Address: 17 Central Buildings, Market Place, Thirsk, YO7 1HD

CONTENTS

1	INTRODUCTION.....	5
1.1	About This Report.....	5
1.2	The Optoelectronics College Project	5
1.3	Method.....	6
1.3.1	<i>Design.....</i>	6
1.3.2	<i>Sample.....</i>	7
1.3.3	<i>Self-Completion Postal Survey (Teachers).....</i>	8
1.3.4	<i>Email Form, Telephone Chase and Web Surveys.....</i>	8
1.3.5	<i>Teacher Survey Response</i>	9
1.3.6	<i>Pupil Survey Response</i>	9
2	CHARACTERISTICS OF SCHOOLS.....	10
3	THE OEC PROJECT.....	11
3.1	Uptake of Science and Impact on Pupil Learning.....	11
3.2	Pupil Views on the OEC Project	12
3.3	Training and Support Materials.....	12
3.4	Open Questions regarding the OEC Project.....	13
3.4.1	<i>Teachers' Views on the 'Best Things' about the OEC Initiative.....</i>	14
3.4.2	<i>The OEC Work can be Improved by... ..</i>	16
3.4.3	<i>The Most Significant Impact on Pupils' Learning has been... ..</i>	17
4	SOLAR CELLS IN ACTION TOPIC.....	20
4.1	Teacher Survey.....	20
4.2	Pupil Survey.....	25
5	COLOUR VISION AND DISPLAYS TOPIC.....	26
5.1	Teacher Survey.....	26
5.2	Pupil Survey Responses.....	30
6	ILLUMINATION AND COMMUNICATION TOPIC.....	31
6.1	Teacher Survey.....	31
6.2	Pupil Survey.....	34
7	HUMAN VISION	36
7.1	Teacher Survey.....	36
7.1	Pupil Survey.....	37
8	CONCLUSIONS AND RECOMMENDATIONS	38
	APPENDIX 1 - Scottish Teacher Questionnaire	
	APPENDIX 2 - English Teacher Questionnaire	
	APPENDIX 3 - Scottish Pupil Questionnaire	
	APPENDIX 4 - English Pupil Questionnaire	

EXECUTIVE SUMMARY

Introduction and Method

This independent evaluation for the Optoelectronics College (OEC) Curriculum Initiative examines teachers' perceptions of the impact of the initiative and the views of a small sample of pupils. James Lambley & Associates (JLA) was commissioned in September 2013 to undertake this work.

In October 2013, schools (teachers) who had been to a training session were asked to fill in a paper questionnaire and also to indicate whether they would be willing to ask their pupils to undertake a short survey. The questionnaire pack included a postage-paid envelope for return to the evaluators.

To enhance the response, JLA undertook telephone follow-up; form email and a web-survey. The teacher response rate was 32.5% and the quantitative results (highest level) are reliable to 95% confidence with a 6% margin of error.

Summary and Recommendations

Overwhelmingly positive results were received relating to:

- All four individual kits and their
 - o Impact on teachers
 - o Impact on pupils (NB. with variable results for choosing science options)
- Training (CPD) sessions
- The OEC Curriculum Initiative overall (qualitative feedback)

Less positive results were seen for:

- Increased take-up of science, specifically as a result of the OEC Curriculum Initiative
- Website use
- With an additional issue of non-receipt of kits in a few instances

Inconclusive results were displayed for:

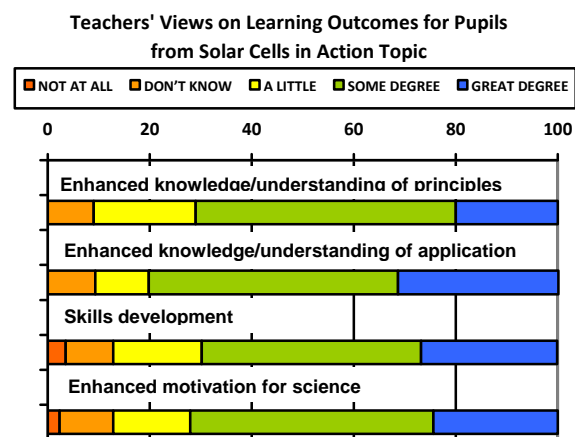
- Embeddedness of kits into courses.

The large majority of open text (qualitative) responses received were positive, with high praise received particularly for the quality of the kits and their use in the classroom.

Teachers were highly positive about the 'joined-up' nature of the OEC Curriculum Initiative in its delivery of training and kits with additional resources. Many felt that OEC had plugged a huge gap that existed for well-designed specialist equipment that was suitable for hands-on use by pupils to bring optoelectronic concepts to life. They

also commented upon the value of receiving training and practical suggestions for teaching up-to-date optoelectronics applications, and increasing their own knowledge and confidence.

According to the overwhelming majority of teachers using the kits, pupils develop an increased knowledge and understanding of science principles; enhanced knowledge and understanding of the application of scientific principles; enhanced investigative skills, and higher motivation due to the OEC kits. Feedback has also highlighted the real-world application of the resources and greater understanding of the wide range of optoelectronic career possibilities.



There was a positive response to lessons using OEC kits by pupils. The most common statements selected to reflect their experience of the OEC topics they had been taught were 'I want to do more work like this' and 'It made me think'. Teachers provided little evidence that the OEC had an identifiable positive impact upon take-up of science subjects in a yes/no question, often accompanied by comments that all pupils are required to study science to GCSE/ Standard Grades. Teachers were more inclined to attribute a higher likelihood of pupils choosing science options to the OEC curriculum in more modulated scale questions.

Very few negative comments were received. They were focused on quality and the occasional non-arrival of kits.

Some teachers requested more kits to enable pupils to be more hands-on. They also requested details of where to obtain more kits and/or spare parts.

1 INTRODUCTION

This report provides results from the independent evaluation of the Optoelectronics College (OEC). The Optoelectronics College provided training, equipment and teaching resources to schools to aid the teaching of physics.

1.1 About This Report

Throughout this report, the following conventions have been followed:

CPD	- Continuous Professional Development
CV&D	- Colour Vision and Displays
HV	- Human Vision
IC	- Illumination and Communication
IOP	- Institute of Physics
JLA	- James Lambley & Associates
KS	- Key Stage
OEC	- Optoelectronics College
S1, S2	- Secondary 1, Secondary 2 etc. (Scotland)
SCiA	- Solar Cells in Action
Y7, Y8	- Year 7, Year 8 etc. (England)

Tables and graphs are all labelled with a simple sequential 'Figure Number' and title. All have clearly labelled base sizes (for sub-groups) and textual definitions of bases.

Percentages are shown with 0 decimal places, hence when all categories within a table or graph of single-code answers are added together, the sum may be slightly above or below 100% due to rounding.

1.2 The Optoelectronics College Project

The Optoelectronics College was founded by Professor Ian Shanks. He was supported, in its pilot in Scotland, by Professor Wilson Sibbett. Both are members of the Optoelectronics Advisory Committee of the Rank Prize Funds. The pilot was extended to England by Professor Cyril Hilsum, chairman of the committee. The idea behind the project was to support and equip secondary school science teachers in the teaching of modern optoelectronics theory and applications to 11-13 year olds and, through these activities, encourage more young people to choose to study science in school and beyond, and to consider careers in science, engineering, medicine or teaching¹.

After a mini-symposium to select topics and the design of teaching materials and equipment in 2007, the Solar Cells in Action pilot in schools was launched in June 2008, with a pilot CPD session in the following November, and training of the trainers for this, SCiA topic in 2009. Key volunteers were Stuart Farmer, Rhona Goss, Bob Kibble and Professors Miles Padgett and Catrina Bryce of the Steering Group and Gordon Doig, Gregor Steele, Alex Munro and other OEC Fellows in Scotland. Helen Pollard, Helen Smith and various CPD trainers were key contributors in England. The kits were procured through FifeX Ltd, JJM Electronics and Mindsets Ltd. All their contributions are gratefully acknowledged.

Three (later four) sets of activities, relevant both to the apposite curriculum and pupils' everyday lives, were designed to enable more engaging, exciting and up to date teaching and learning of science. Due to initial funding constraints, the supporting kits in Scotland required some technician/teacher assembly, whereas the kits in England did not.

¹ The Optoelectronics College has been funded by the Rank Prize Funds with additional support from the Scottish Government and a variety of UK based companies and charities.

Solar Cells in Action (SCiA): Enabling investigation of how a solar cell converts energy, things affecting its operation and how it is used, including the generation of 'green' electricity from sunlight. Using light to charge a solar buggy, measure its range and activity to compete against classmates.

Colour Vision and Displays (CV&D): Learning about colour vision and surveying public perceptions about this. Exploring additive mixing of primary colours and how displays work, such as LCDs for laptops and TV.

Illumination and Communication (IC): Enabling investigation of how an LED generates light without heat, how it can produce different colours and many of its uses, including future environmentally friendly room lighting. Using a hand generator to power LED and halogen spotlights of comparable light output to feel the difference. Learn how optical fibres work to transmit telephone and internet signals.

Vision (HV - Optional alternative to CV&D in England only): Using a video camera, monitor and other equipment to understand the basics of how we see, how glasses work, persistence of vision, colour addition, how an LCD works and what the world looks like with various defects and diseases and how these can affect the lives of millions of people.

Each topic was supported with equipment, training, and CPD resources and each is evaluated in a discrete section of the report.

Phase 1 of the pilot was completed in Scotland with 150 SCiA, 116 IC and 112 CV&D kits provided free to more than a third of all secondary schools, with 101 such schools having all 3 kits. CPD training was volunteered by OEC Fellows at over 40 workshops, attended by more than 300 Scottish Science teachers, who became Members of the OEC.

In England, Phase 1 has seen 330 Science teachers, from over 320 schools, trained and equipped, with around 200 schools having three kits (SCiA, I&C and either CV&D or HV). The OEC website is at www.opto.org.uk and the password 'opto123' opens encrypted files.

1.3 Method

James Lambley & Associates (JLA) was commissioned by the OEC in autumn 2013 to undertake an evaluation of the OEC project. The proposal outlined a flexible method with an emphasis on paper-based self-completion survey. This sub-section summarises the methods used throughout the evaluation.

1.3.1 Design

Prior to the commission, proposals were put forward regarding the design of the evaluation. These proposals suggested a paper-based, self-completion evaluation with teachers. Teachers would be asked whether they would be willing to administer a short pupil questionnaire to pupils who had used the equipment.

JLA accepted the main method and question areas laid out in the proposals. In early October the JLA team designed four paper-based self-completion questionnaires for Scottish teachers, English teachers, Scottish pupils and English pupils. The English and Scottish versions differed by virtue of the additional topic in the English project and due to the slightly different nomenclature of English and Scottish school systems (see Appendices 1 and 2). The pupil questionnaire was limited to one sheet of A4 paper and was more colourful and easy to complete (see Appendix 3).

Each draft of the questionnaires was sent to Prof. Ian Shanks who helped ensure that the questionnaires and nomenclature were applicable to the project. The design also considered clarity, ease of completion and size for posting.

1.3.2 Sample

JLA received sample spreadsheets containing details of both English and Scottish schools involved in the project at the end of September 2013. The format of the samples differed hence JLA approached their management differently, as described below.

The OEC Scottish sample was provided in one Excel spreadsheet and one scanned document. Unlike the English sample, the Scottish sample included neither telephone numbers nor email addresses. The sample did have full name and address details. The sample spreadsheet comprised a listing of 274 individuals from 171 schools and other institutions. Thus JLA sourced telephone numbers, and where possible, email addresses, for all Scottish schools on the sample in preparation for the telephone chase. This was achieved by searching for telephone numbers on the internet, and seeking confirmation by telephoning all schools' reception staff. This exercise enabled JLA to clarify the sample further through asking for the teachers' email addresses. In some cases no details were released by receptions, and others stated that teachers had moved on.

JLA removed several non-school institutions (e.g. University Departments) from the sample. During the sample clarification process, the sample was reduced further due to a variety of reasons, including schools having closed down, and schools in which all teachers involved with OEC had left. It was also agreed with OEC that schools that had received the kits very recently (summer term 2013) would be excluded from the sample. Thus the number of active schools, i.e. our final sample, contained fewer schools than the original sample provided. Schools that stated that they had attended the training but stated that they either had not received or 'lost' the kits were retained in the sample.

Summary of Sample for Scotland

- 171 institutions in spreadsheet from which non-school institutions were removed
- 160 'in scope' schools
- 2 schools had closed down
- 1 reported having had no training nor kits
- 25 schools had no teachers trained by OEC remaining, the teachers having moved on or retired. In 15% of schools, reception would not confirm either way (a misinformed application of data protection).

The 'active' sample for Scotland was: 132 schools.

As explained above, the English sample sheet differed from the Scottish. The English spreadsheet comprised 317 training records of which 311 had received training in at least one of the topics. The earliest training recorded for training was summer term 2011. The OEC records also indicated the number of schools which received kits for one or more of the 4 topics, as shown below.

Topic	No
CV&D	233
IC	261
SCiA	136
Vision	81

When de-duplicated, there were 299 individual institutions recorded on the English sample spreadsheet. Of these 299 institutions, telephone numbers (some of which were mobile numbers) were supplied for 223. 241 had either a work or a personal email address recorded. Some of these institutions had been trained too recently to be included in the sample (the cut-off was Spring 2013) and several university and other non-school institutions were removed. The English schools sample now contained 280 schools.

As was the case with the Scottish sample, the 280 schools in the English sample were reduced further to leave a smaller active sample.

- 317 training records which was converted to number of institutions and de-duplicated.
- 280 'in scope' schools
- 2 schools had closed down
- 13 schools in which all teachers trained by OEC had left (although for the English sample, as there was not a 100% sample telephone exercise, there may have been more schools in this category).

1.3.3 Self-Completion Postal Survey (Teachers)

The signed-off English and Scottish questionnaires were printed and despatched by JLA on 14/15 October 2013. Each questionnaire included a request to teachers to indicate whether they were prepared to ask their students to complete a short pupil survey (see Appendices 1 and 2).

In total 440 questionnaires (280 English, 160 Scottish) were posted 1st class. The pack contained the questionnaire, introductory letter, and a return paid first class envelope. From this initial mail out, there were very few responses.

Responses were tracked on the response tracker, however a high proportion of schools chose not to reveal their school names, resulting in these returns not being attributed to a particular school.

1.3.4 Email Form, Telephone Chase and Web Surveys

Since the initial response from the postal survey was so disappointing, JLA decided to instigate further methods of obtaining responses through email and telephone chases. For the Scottish sample, the team initially undertook a comprehensive internet search to source school email addresses and telephone numbers, followed by telephone contact with the majority of schools to check whether the OEC trained teachers were still in school and to obtain direct email addresses for individuals where possible. The English sample contained email addresses and telephone numbers.

It was also decided to widen the sample pool at this point to include all English schools in receipt of some training before the end of April 2013.

The teacher questionnaires were adapted to become 'form' format, to enable recipients to 'click' to mark tick-box type responses and type text responses straight into boxes within the document electronically.

Over the fieldwork period, up to 5 emails were sent to individual schools. Each email contained three attachments: the introductory letter; the teacher questionnaire in 'form' format and the student questionnaire.

The JLA team undertook a further round of telephone calls to schools to source new emails for emails which had failed (teacher turnover, school name changes etc.).

A telephone chase was undertaken mainly in the hours between 8.15am and 9.00am, lunchtime, and from 2.50pm. The number of calls made to schools varied according to the outcome. In many instances researchers were asked to send an email to the school office, often teachers were unavailable/could not be found, and in some cases researchers were told that the teacher(s) asked for had left. Some teachers made appointments to be called back. When the teacher was available and willing, telephone interviewing, using the same survey instrument, was undertaken.

The tracking of returns continued through the email and telephone chase phase, but a high proportion of schools continued to not reveal their names. Some schools could be deduced from the email address, email footer, or the teacher name. Many were still anonymous, resulting in some schools being 'chased' when they had completed a survey.

As responses were still slow to come in, JLA then asked permission to launch a web survey version of the teacher questionnaire, which was given. The English and Scottish versions were both programmed, and then checked by the OEC. The link to the survey was embedded in an email sent out to schools with the form version also attached.

1.3.5 Teacher Survey Response

Figure 1 below shows the response counts and rates of the teacher survey. The response rates for this survey are relatively good at 39.4% for Scotland and 29.1% for England. The response rate for Scotland is higher largely because the base (Active Population) is more accurate and the base for England is conservative.

Figure 1: Survey Response Rates and Counts (Schools)

	Population (In Scope Sample)	Removed*	Active Population	Number of Responses	Response Rate (%)
Scotland	160	28	132	52	39.4
England	280	15	265**	77	29.1
Overall	440	43	397	129	32.5

Population (number of schools)

* School closed down, all OEC trained teachers left etc.

** This is the maximum possible active population. In reality fewer schools would have been found in the active population.

Given that this is a finite population: i.e. we are not extrapolating to the general population, the whole sample data (Scotland and England combined) is reliable at the 95% confidence level with a margin of error (confidence interval) of +/-6%.

1.3.6 Pupil Survey Response

A total of 73 pupil responses were received (in some cases students had completed the questionnaires in the pairs they worked in, agreeing the responses to give). Forty-nine responses came from male pupils, 20 from female pupils and 4 did not indicate their gender.

However, very few of the schools who agreed to complete the pupil survey actually returned the questionnaires. Hence the responses come from a small pool of schools: 26 responses from a total of 3 schools in England, and 47 responses from 3 schools in Scotland. One school was boys-only.

Responses came from a range of year groups with 21 responses from pupils in Y7/S1; 17 responses from Y8/S2; 26 responses from pupils in Y9/S3; and 9 from pupils beyond Y9/S3.

2 CHARACTERISTICS OF SCHOOLS

This section describes the characteristics of the schools that responded to the survey. Nearly 9 in 10 (88%) schools have mixed gender populations. All the Scottish schools that responded to the survey were mixed gender (see Fig. 2).

Figure 2: School Characteristics (Gender)

Base: All respondents

	Girls	Boys	Mixed
Overall (%)	9%	4%	88%
Scotland (counts)	0	0	47
England (counts)	10	4	53

Population (number of schools)

Four in five schools (82%) in the respondent sample were non-fee paying schools.

Figure 3: School Characteristics (Fee Paying/Non-fee Paying)

Base: All respondents

	Non-Fee paying	Fee Paying	Not Stated
Overall (%)	82%	17%	2%

3 THE OEC PROJECT

The survey began by asking teachers their views on the OEC project overall: the best things about the OEC curriculum initiative; how it could be improved; and the most significant impact on pupil learning. These questions were open text questions apart from a quantitative 'choose one response' question regarding change in uptake of science. The results are shown in the sub-sections below.

3.1 Uptake of Science and Impact on Pupil Learning

One of the aims of the project was to encourage more students to take up science at GCSE/Standard Grades or A Level/Highers. Respondents were asked whether in their opinion the uptake of science in options had increased due to the OEC project. The majority of respondents (77%) were unable to state whether there had been a change or opted to state that there had been no change, since all students take GCSE/Standard Grade science, or because there are too many variables in school to attribute any changes to one project (see Fig.4).

Figure 4: Increased Uptake of Science

Base: All respondents

	Yes	No	No change/ Don't Know
Overall (%)	8%	15%	77%

"[There is] No evidence to say this has had an impact if they are going on to choose science"
English School (Girls, non-fee paying)

However, when asked to complete the sentence 'The most significant impact on pupil learning has been...' nearly one in three (29%) comments identified the positive impacts of the OEC on the precursors to choosing to continue in science i.e. pupil enjoyment and/or engagement (see Section 3.4.3, below).

"...in their understanding of how colours of light mix - it was difficult before to 'prove' to them that green, blue and red light mix to make white as our resources did not readily show it. However the equipment we have has definitely improved the teaching of this topic."
English School (Mixed, non-fee paying)

"...increased interest in physics/science."
Scottish School (Mixed, non-fee paying)

"...improved enthusiasm for the subject due to pupils making better connections to real-life situations."
Scottish School (Mixed, non-fee paying)

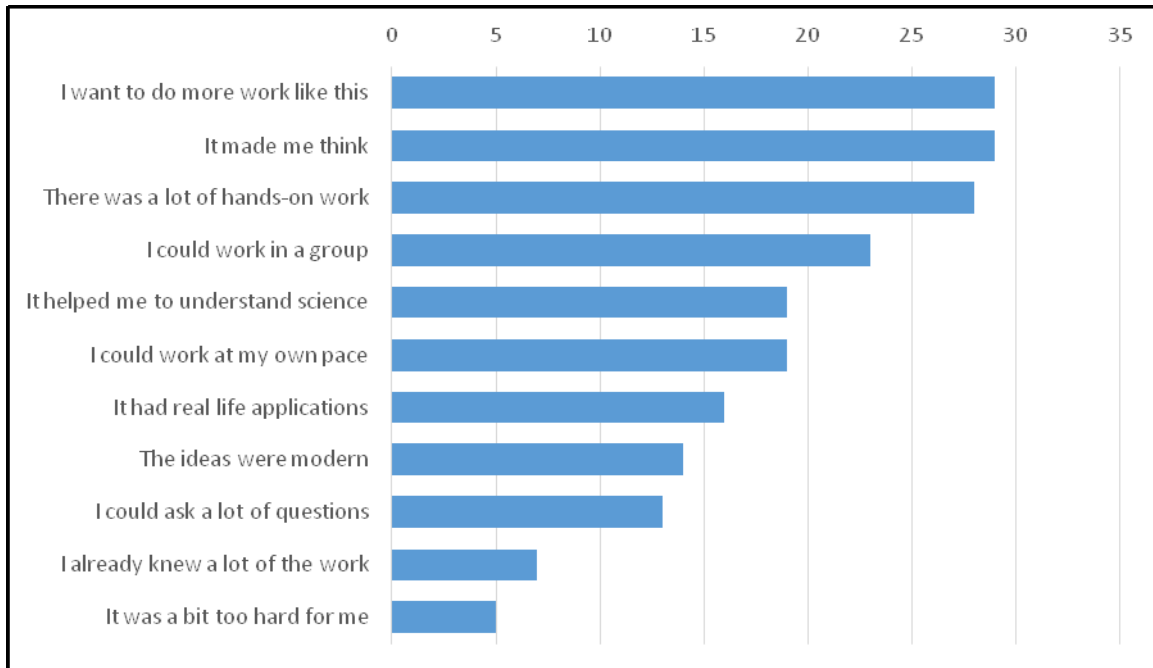
"... 'hands on' always improves our learners' experiences and understanding and this is certainly the case here."
English School (Mixed, non-fee paying)

3.2 Pupil Views on the OEC Project

Pupils were asked to pick three out of eleven diverse statements to describe their experience and views of the optoelectronics topics with which they had had contact. All but 4 pupils undertook this task. The results are shown in Fig. 5, below.

Figure 5: Statements about the OEC Topics

Base: Pupils answering question (69)



Although the base is small, the results are encouraging with the two most popular statements being 'I want to do more work like this' and 'It made me think' with 42% of pupils (29 individuals) selecting these statements. Also extremely positive is the high proportion of pupils who chose to select the statement 'It helped me understand science'. Also encouraging is that over one quarter (19 individuals/28%) chose to circle the statement 'It helped me to understand science'. Only a minority of pupil respondents chose to circle the statement 'It was a bit too hard for me' (5 individuals/7%).

A relatively high proportion of these pupils chose to select the statements 'There was lots of hands-on work' (28 individuals/41%) and 'I could work in a group' (23 individuals/33%)².

3.3 Training and Support Materials

Teachers were asked to assess the usefulness of the training and support materials that were provided by the OEC to support use of the equipment in classroom teaching. The training and support comprised Continuous Professional Development (CPD) training sessions; a website resource; and CD and paper-based resources.

Nearly two thirds (66%) of the respondents indicated from a prompted scale that the CPD sessions were 'invaluable' or of 'significant use' with a further 14% stating that the sessions were of 'some use' (see Fig. 6). The CPD sessions were overwhelmingly the most popular

² This group of pupils is a 'self-selecting' sample (teacher selected sample) caution should be applied when interpreting these results.

and well received of the resources: nearly one third of respondents (32%) indicated that the CD and/or paper-based resources were either 'invaluable' or 'of significant use'; one fifth (20%) of respondents indicated that the website was either 'invaluable' or of 'significant use'.

Unsurprisingly, the CPD sessions were the most used of the resources, with 17% of respondents stating that they had either not used the training or did not know about it/its effectiveness.

Figure 6: Usefulness of OEC Training and Support Materials

Base: All respondents

	Invaluable	Significant Use	Some Use	Limited Use	Not Used	DK
	%	%	%	%	%	%
CPD sessions	20	45	14	4	5	12
Website	3	17	24	14	31	12
CD / Paper-based resources	4	28	26	7	21	14

Qualitative commentary from the survey responses indicates that the CPD sessions were valued by teachers not only for the specific content relating to the equipment provided by the OEC, and for the holistic package put together by the OEC, but also for the chance to meet colleagues and engage in professional discourse with peers. The following comments were provided in response to the open questions 'The best things about the OEC curriculum initiative are...' and 'Do you have any additional comments to make about the resources?'

"Being provided with training on how to use the kit rather than being expected to figure it out and work out how best to use it in lessons."

English School (Mixed, non-fee paying)

"Great kit and networking opportunities to get fresh teaching ideas."

English School (Boys, non-fee paying)

"An excellent all round package. Well designed and supported."

Scottish School (Mixed, non-fee paying)

"The full range of materials/equipment/training are brilliant (sic)."

Scottish School (Mixed, non-fee paying)

"The resources have been very useful and have allowed teachers who were not at the courses to use the kits with confidence."

As with any initiative designed for use within schools, teacher time is always a problem. Some respondents admitted that they forgot to use resources or didn't have time to access them.

"Keep forgetting about the website for resources, but will try to go on soon. Too busy this academic year."

Scottish School (Mixed, non-fee paying)

3.4 Open Questions regarding the OEC Project

Teachers were asked to complete three sentences/paragraphs relating to the OEC project. These were:

- The best things about the OEC curriculum initiative are...

- The OEC work can be improved by...
- The most significant impact on pupil learning has been...

This subsection describes these qualitative results. A full list of qualitative comments is attached as an appendix (see Appendix 4).

3.4.1 Teachers' Views on the 'Best Things' about the OEC Initiative

Sixty respondents from English schools and 45 from Scotland provided a comment or comments on what they thought the best things about the initiative are. Quite rightly, teachers recognised the value of the kit and the training and that they were receiving it at no cost. This view is to be expected, as free resources are generally welcomed.

"New equipment into school as science budget is very stretched."

English School (Mixed, non-fee paying)

However, most comments went further with many showing that the respondents particularly liked the joined up nature of the training and the equipment. Also of note in these non-prompted answers are the frequent statements about the quality of the initiative, both its training and the kits.

"Training and resources that match."

English School (Mixed, non-fee paying)

"The quality and breadth of the resources AND the fact that we were given a day's tuition on how to use them."

English School (Mixed, non-fee paying)

"Well thought through activities with the kit needed for delivery in the classroom supported by good quality CPD."

Scottish School (Mixed, fee paying)

The fact that the equipment fills a gap was also identified as a key reason that teachers liked the OEC curriculum initiative. The gap seems to be the availability of specialist well-designed equipment that can bring science to life and to make certain scientific concepts more understandable for pupils through demonstration and experimentation, and which teachers can use relatively easily as a class activity.

"They are quite specialist pieces of kit that are not readily available elsewhere so they are unique - really good. It is almost like it is a specialist area and we have specialist kit made by expert."

English School (Mixed, non-fee paying)

Teachers' comments illustrate how they have found the OEC initiative not only helpful for their pupils' learning but also for their own teaching. The opportunity for professional discourse at the training was also mentioned by some.

"Provides more ideas for teaching Optoelectronic-related topics at KS3."

English School (Mixed, non-fee paying)

"Resources produced as complete, easy to use pack."

Scottish School (Mixed, non-fee paying)

"It has allowed us to improve our own knowledge in particular areas and with the kits given to the school, allowed this to be taken further in the classroom."

Scottish School (Mixed, non-fee paying)

"It gave us some new ideas. It was also nice to meet other people from other schools and see new initiatives."

English School (Girls, fee paying)

"Having up to date equipment to use for practical work and demos in class. Workshops using the kit give teachers confidence in using the equipment with their classes as well as new ideas for teaching."

English School (Mixed, non-fee paying)

Some respondents indicated that the best feature of the curriculum initiative was the currency of the equipment and the relevance and application of the optoelectronic themes to real life and in modern technology.

"Up to date take on real world interaction. Simple to use."

Scottish School (Mixed, non-fee paying)

"Good quality components that pupils can use to generate useful data. 'State of the Art' equipment covering topical issues in physics and society. Worksheets and suggestions that demonstrate relevance of optoelectronics in society."

Scottish School (Mixed, non-fee paying)

"[They] provide a relevance and a discovery that current methods lack."

English School (Mixed, non-fee paying)

"Giving everyday/real life context to what can be difficult ideas."

English School (Mixed, non-fee paying)

Furthermore, in these non-prompted comments, teachers noted the relevance and utility of the kits to the curriculum and to extra-curricular science project work.

"The colour mixing kit and the LCD display unit which together with the ppt and background material added depth to the curriculum."

English School (Mixed, non-fee paying)

"Experimental equipment specific to the courses that works well."

English School (Mixed, non-fee paying)

"Embeds technology and electronics into the physics curriculum. Equipment more encouraging."

English School (Mixed, non-fee paying)

"The resources that have been provided to the school have been useful and helpful in teaching the new learning outcomes of CfE."

Scottish School (Mixed, non-fee paying)

The impact on pupils was highlighted by some respondents, including linking optoelectronics themes to careers, increasing pupils' interest, enhancing their skills and giving them opportunities to engage in hands-on scientific experimentation in physics.

"Making things easy for pupils to assimilate with demos and experiments that work."

Scottish School (Mixed, non-fee paying)

"Pupils are able to use real opto-electronic equipment and connect it to career options."

Scottish School (Mixed, non-fee paying)

"Helping students develop understanding of relationships/variables. That white light is a mixture of RBG."

Scottish School (Mixed, non-fee paying)

3.4.2 The OEC Work can be Improved by...

Many of the statements provided by teachers when asked to complete the statement 'The OEC work can be improved by...' seem to be statements of support for the project, either asking for an expansion of the project in some way or for wider publicity of the initiative. Some teachers stated that they didn't think any improvements could be made.

"Not sure it can. They already discuss things with teachers to make sure the courses and resources are appropriate for our needs."

Scottish School (Mixed, non-fee paying)

"By extending it to KS4 & KS5."

English School (Mixed, non-fee paying)

"Increasing the amount of equipment given to schools, and broadening the range of learning outcomes that it can apply to."

Scottish School (Mixed, non-fee paying)

"Expanding the range of experiments, having new apparatus for new procedures."

Scottish School (Mixed, non-fee paying)

"Possible further training or feedback sessions."

English School (Mixed, non-fee paying)

"Wider publicity in the school physics community."

Scottish School (Mixed, non-fee paying)

There were other comments regarding areas in which the teachers think the OEC could improve their experience. Elsewhere in the evaluation, we see teachers asking for a clearer idea of how to buy additional kit or replacement parts and these issues were raised here also.

"More networking opportunities in the South of England - I have not been able to make it to other get-togethers because of travel time."

English School (Mixed, non-fee paying)

"Differentiated worksheets to support materials."

English School (Mixed, non-fee paying)

"Providing an up-to-date catalogue of equipment that is available to all schools."

English School (Mixed, non-fee paying)

Across Scottish and English schools, some comments related to ensuring the curriculum kit or future kits match the changing curriculum. This was particularly, but not exclusively, prevalent in Scottish school responses.

"Identifying opportunities in the new Curriculum of Excellence courses."

Scottish School (Mixed, non-fee paying)

"Looking for activities within new course content that can be supported with innovative practical work."

Scottish School (Mixed, non-fee paying)

"Tying in with the new qualification e.g. National 3, 4, 5 and the new Higher Physics."

Scottish School (Mixed, non-fee paying)

"I like the flexibility the kits supply but perhaps a look at Nat 3/4/5 and the new H/AH courses would allow specific course contents to be met. In the new courses we have an assignment that optoelectronics lends itself in terms of application and practical."

Scottish School (Mixed, non-fee paying)

"I suggest you look at the new KS3 & KS4 Curriculum for Science and link the use of the equipment to activities that match what will need to be covered."

English School (Mixed, non-fee paying)

Respondents offered other ideas which were more specific and included several comments related to putting the kits together.

"Instructions with kits / on CD especially since kits took a while to come. I had taken notes but they were not complete."

English School (Girls, fee paying)

"LCD display is overly complicated and not worth including too small for easy whole class use."

English School (Mixed, non-fee paying)

"Making up kits can be hard to arrange, unless part of the learning is in the building, ready-made kit is easier to put into lessons."

Scottish School (Mixed, fee paying)

"A clearer photograph and circuit diagram of correctly assembled kits."

Scottish School (Mixed, fee paying)

There was a significant minority of respondents who stated that even though they had been on the course, the materials had not arrived. The exact number of schools in this position is difficult to ascertain since in some, the relevant teachers had moved on or retired.

3.4.3 The Most Significant Impact on Pupils' Learning has been...

The third question is potentially the most important, that is, eliciting the views of teachers on the impact of the OEC project on their pupils' learning.

For this question, the comments naturally grouped into 3 themes, with only four comments falling outside these broad themes (see Fig.7). In total, 97 comments were provided, 41 from Scottish schools and 56 from English schools.

Figure 7: Qualitative Themes – Pupil Outcomes (counts)

Base: All respondents to the question (97)

	England	Scotland	Total
Increased engagement, interest and/or understanding	28	20	48
Increased investigation, investigative/scientific skills	15	9	24
Availability of equipment, real-world examples, ability to be hands-on	9	12	21
Outside these themes	4	-	4
Totals	56	41	97

Qualitative responses are to be found in Appendix 4.

Theme 1: Increased interest, engagement and/or understanding

Teachers provided varying degrees of detail when describing the most significant impact of the project on their pupils. Often the replies which we have grouped in this theme referred to a *combination* of interest and engagement in, and understanding of, the subject matter.

"Understanding of different colours within white light. Enjoyed solar buggies investigation."
English School (Mixed, non-fee paying)

"Widespread, across the class, understanding of the topics as they were demonstrated (lots of 'oh that's how it ...' comments.)"
Scottish School (Mixed, non-fee paying)

"Increased interest in solar physics."
Scottish School (Mixed, non-fee paying)

"Enthusiasm to learn from their involvement - most welcome feedback was from a Y9 who suddenly linked the order of the electromagnetic spectrum to the voltage required to 'switch on'."
English School (Mixed, non-fee paying)

"It has helped them understand colour. The solar cell buggies have been very popular as an investigation tool. The 'wind up' light is excellent for quickly demonstrating the difference in energy demand of the two bulbs...The kit has been used in many ways with a wide range of ages and abilities and the feedback has been very positive as they really enjoy hands on. Basically we would never have considered purchasing such equipment purely because we do not have the funds."
English School (Mixed, non-fee paying)

"Interest in electronics and opto as a result of using the kits instead of simply web-based research."
Scottish School (Mixed, non-fee paying)

Theme 2: Increased investigation, investigative/scientific skills

Developing pupils' investigative techniques and scientific thinking is difficult in a pressurised curriculum with limited resources. It is, however, key to understanding difficult concepts and in maintaining an enjoyment in the study of science. Twenty four teachers identified the positive impact the kits had on this aspect of learning (unprompted).

"Good investigative work with 'real world' data that doesn't just give 'straight line' results."
Scottish School (Mixed, non-fee paying)

"Developing skills for scientific enquiry."
Scottish School (Mixed, non-fee paying)

"Greater independence in investigations (solar buggies)."
English School (Mixed, fee paying)

"Kits encourage pupils to ask questions and present opportunities for pupils to innovate with the components available."
Scottish School (Mixed, non-fee paying)

"Developing investigative techniques. Pupils have a better understanding of variables. Precise timings/measuring."
English School (Mixed, non-fee paying)

"The ability to discuss a concept then trial it with the solar cells in action kit."
English School (Mixed, non-fee paying)

Theme 3: Availability of equipment, real-world examples, ability to be hands-on

A selection of teachers chose to describe the impact on their pupils in terms of the equipment that was made available to them; the fact that the kits made the science more relevant to the real world; and that it enabled pupils to learn by being hands-on with equipment. While we may assume that these factors could increase enjoyment and understanding of the subject, the teachers did not expressly state that this was the case.

“An appropriately supported and funded initiative has been very useful so pupils have hands-on experience of OEC type activities.”

Scottish School (Mixed, non-fee paying)

“Standard of the kit and the increase in access to practical tasks.”

English School (Mixed, non-fee paying)

“Demonstrating modern uses of technology and making relevant links to life outside school.”

Scottish School (Mixed, non-fee paying)

“Having equipment that is intuitive to use and reliable means that pupils quickly get to use it for its intended purpose and teachers can deploy it confident that the equipment will not limit the learning.”

English School (Mixed, non-fee paying)

“Pupils are able to use real opto-electronic equipment and connect it to career options.”

English School (Mixed, non-fee paying)

“We’re now in a position to use hands-on equipment, rather than ICT for science lessons.”

Scottish School (Mixed, non-fee paying)

Other

Four comments were made that did not fit into the back-coded categories above. Two teachers stated that they could not say that the kit had had a specific impact. Another stated that s/he had not taught the subject for a while and therefore could not comment, and the final statement indicated the respondent’s view that the main impact on pupils’ learning was the fact that it was a girls’ school and girls could feel free to choose and enjoy science more without the influence of boys.

4 SOLAR CELLS IN ACTION TOPIC

This section provides results for the Solar Cells in Action (SCiA) topic.

4.1 Teacher Survey

Three quarters (75%) of the teachers responding to the survey stated that their school had received a Solar Buggy (SCiA) kit (see Fig.8). The remainder of this section will use those that received the kit as a base.

Figure 8: Schools Receiving the SCiA Kit

Base: All respondents

	Yes	No	No response
Overall (%)	75	23	2
Scotland (counts)	36	11	
England (counts)	50	15	

Over one fifth (22%) of schools that received the kit did so between 2008 and 2010 inclusive. The year showing the highest proportion of receipt of kits is 2011 (29%). Nearly one third of kits were received in 2012 and 2013 (31%). A high proportion of schools (17%) stated that they didn't know when they received the kits (this usually being due to the kits having been received some time ago).

Respondents were asked to indicate with which year groups the kit has been used. The results indicate that the higher the year group within the range, the higher the proportion of schools indicate that they use the kit with that year group (see Fig. 9).

Figure 9: Year Group Use of the Kit

Base: Schools receiving the SCiA Kit (86)

	%
Y7/S1	37
Y8/S2	41
Y9/S3	45
Other	37

The qualitative/'open' responses revealed that many teachers use the kit in 'A' level/Higher groups, with a range of year groups depending on the curriculum, and with Science Clubs and on Open Days.

"[Used with] Years 7 and 9 in energy and sometimes with 6th formers.... One thing that helped was GCSE ISA, one of them involved solar cells so useful to have the kit. Would help if we had more – so that's why it is better in an A level group."

English School (Mixed, non-fee paying)

"Used as an investigation practical for S1 and S4. Also used by young engineers club for S1-S6."

Scottish School (Mixed, non-fee paying)

“Mainly used with Y9 and Y10 and for extra demos - it's quite good! We have an energy circus that we run with Y9 and it is well used there. We do have a project week and one group looked at the buggies and what they can do - they got a lot out of it. It is embedded with sixth form.”

English School (Mixed, fee paying)

Teachers were asked to assess whether the kits had been used with all appropriate classes, most appropriate classes, some appropriate classes, or to indicate if the kits had not yet been used in class. Three in ten schools (29%) indicated that the SCiA kit was being used with all appropriate classes, and a further two in ten (20%) used the kits with most appropriate classes.

Figure 10: Use with Appropriate Classes

Base: Schools receiving the SCiA Kit (86)

	%
All appropriate classes	29
Most appropriate classes	20
Some appropriate classes	43
Not yet used	7
D/K	1

Respondents were asked whether, in their opinion, the SCiA topic and kit is embedded in their course. The responses showed a nearly even split between those who thought that their SCiA kit is embedded (48%) and those who stated that it is not embedded (49%) (see Fig. 11). This is a very encouraging result given that some kits would not have been received until the 2012/2013 academic year, and correlates closely with schools using the kits with most or all appropriate classes.

Figure 11: Embeddedness of Kit

Base: Schools receiving the SCiA Kit (86)

	%
Yes	48
No	49
Not stated	3

Respondents were asked to provide further detail about the use/embeddedness of the kit in their school.

“Y9 & Y10 - generally very well embedded. It works well with the syllabus - it's good. Very good for average to weak students - and the brighter ones want to unpack it a bit.”

English School (Mixed, non-fee paying)

“When teaching renewable energy or even just identifying the energy changes which take place in a given object. The solar cell kit has been useful.”

Scottish School (Mixed, non-fee paying)

“A KS3 lesson has been written using the solar cells as part of the school's curriculum, we link it in with the use of solar cells in under developed countries for example solar powered well.”

English School (Mixed, non-fee paying)

“Have been factored in to a unit on "energy" with S1 now.”

Scottish School (Mixed, non-fee paying)

“Years 7 and 9 in energy and sometimes with 6th formers - yes it is embedded. Prior to that we had nothing as nice... One thing that helped is GCSE ISA, one of them involved solar cells so it was useful to have the kit. It would help if we had more - so for now it's better in an A level group.”

English School (Mixed, non-fee paying)

“Simple to incorporate in the curriculum for excellence.”

Scottish School (Mixed, non-fee paying)

Various issues were raised by teachers in whose schools the kits are not completely embedded or not embedded at all.

“When I received the solar cells kits the department had a new Science technician who lacked confidence to put the kits together. Then, the storage arrangements for the department's equipment were changed. The support staff are just beginning to create an inventory and decide where to store all the equipment. Hopefully they will then be stored in an accessible place and I can get them included in the course.”

Scottish School (Mixed, non-fee paying)

“Not completely but it is starting to be as more (new) staff are becoming confident with using it. I have had to encourage staff to use the equipment as there is a feeling it is 'too nice' and a fear it might get broken! Knowing how we can purchase replacements/ how to repair the kit could be useful.”

English School (Mixed, non-fee paying)

“Embedding new equipment takes time to do properly. Courses are still developing. This new equipment encourages active learning.”

Scottish School (Mixed, non-fee paying)

“As mentioned before 5 buggies is insufficient for 32 pupils.”

English School (Mixed, non-fee paying)

“It is in the SoW [Scheme of Work], but with only a few buggies they're not always used.”

English School (Mixed, non-fee paying)

Respondents were asked to what degree they felt the SCiA kit had an impact upon certain learning outcomes for their pupils. Figure 12 illustrates the results. The vast majority of teachers indicated that the SCiA had an impact on all four outcomes. On two outcome measures, 'Enhanced knowledge/understanding of science principles' and 'Enhanced knowledge/understanding of the application of science principles', all teachers who responded with a view stated that their pupils had experienced a positive outcome. Over 7 in 10 stated (71%) that the SCiA had an impact through enhanced knowledge/understanding of science principles to a great or to some degree. Four fifths (80%) state that that the SCiA had an impact through enhanced knowledge/understanding of the *application* of science principles to a great or to some degree.

Figure 12: Teachers' Views on Learning Outcomes for Pupils

Base: Schools receiving the SCiA Kit (86)

	Great degree	Some degree	A little	Not at all	DK
	%	%	%	%	%
Enhanced knowledge/understanding of science principles	20	51	20	0	9
Enhanced knowledge/understanding of the application of science principles	31	49	10	0	9
Skills development	27	43	17	3	9
Enhanced motivation for science	24	48	15	2	10

Similar proportions of teachers stated that the SCiA had an impact on ‘Skills development’ and ‘Enhanced motivation for science’ to a great or to some degree (70% and 72% respectively). While many teachers were not able to state whether more pupils were choosing to take science in their options (see above and figure below), they were able to state that they perceived an enhanced motivation for science in their pupils.

In the same vein, respondents were asked to what, if any, degree three outcomes for teachers and/or the school have resulted from using the SCiA kit. Of immediate interest is the fact that over three quarters of teachers who responded stated that it enhanced the ability of teachers to design more exciting lessons to a great (26%) or to some (50%) degree. Five percent stated that it didn’t have that outcome at all in their school.

In comparison, there was a slightly less confident response regarding the impact of the SCiA kit on teacher confidence in the classroom, with 7% stating that the kit had enhanced teacher confidence to a ‘great degree’, but nearly half (49%) stating that it had to ‘some degree’, with a further 8% stating it had to a ‘little degree’. In total, nearly three quarters (73%) stated the kit had had some impact on this measure.

“It’s less scary for non-physics specialists - works really well with their confidence.”
English School (Mixed, non-fee paying)

In the dichotomous question discussed above (3.1), a relatively small proportion of respondents indicated that more pupils were choosing science options as a result of the OEC project. When, in a more refined question, teachers were asked whether the SCiA had a similar impact, a more positive picture emerges. Nearly four in ten (38%) of respondents indicated that more pupils were taking at least one science in their options as an outcome from the SCiA to a great (3%) to some (13%) or to a little (22%) degree. Over a quarter of respondents (28%) stated that it did not have that outcome at all, whereas a third (34%) stated that they did not know.

Figure 13: Teachers’ Views on Outcomes for Teachers and/or the School

Base: Schools receiving the SCiA Kit (86)

	Great degree	Some degree	A little	Not at all	DK
	%	%	%	%	%
More students taking at least one science in their options	3	13	22	28	34
Ability to design more exciting lessons	26	50	8	5	12
Enhanced teacher confidence in the classroom	7	49	17	10	10

When asked an open question about how teaching experiences using the SCiA kit could be improved, 49 teachers responded with a range of views. These open comments have been backcoded into themes as illustrated in Fig.14.

Figure 14: Open Text Responses to Potential Improvements to SCiA Kit (counts)

Base: Teachers providing open text (49)

Improvements	No.
Changes to the design	14
Provision of more kits to use in class	12
Improved robustness of kit	12
No improvements required	6
More lesson resources and/or sharing of practice between schools	3
More time in lessons to use them	2

There were conflicting views from teachers on some of the design modifications proposed, with, for example, some teachers wanting smaller buggies and others wanting a larger piece of kit. Six teachers stated that they thought that teaching would be improved if the cars could go faster, and a further three stated that they thought the capacitor should be able to store more energy.

“Provided with a range of capacitors / solar cell sizes? Nice kit, thank you.”

Scottish School (Mixed, non-fee paying)

“Capacitors and motors had higher ratings so that pupils could enjoy higher speeds.”

Scottish School (Mixed, non-fee paying)

“We could directly measure power generated by PV in some way.”

Scottish School (Mixed, non-fee paying)

Many teachers throughout the course of the evaluation stated that they valued the kit very much but that learning and teaching outcomes would be improved if there were more kits either provided, or some stated that they would like to know where further kits could be purchased.

“[If] we had more kits to give more hands on experience.”

English School (Mixed, non-fee paying)

Some teachers thought that the kits could be more robust, although some specifically mentioned that this was more of a problem with the first version of the buggy. Some of the respondents who mentioned fragility of kit had received kit ‘a few years ago’, some in 2008, but some as recently as 2010.

“[If] buggies were more robust - version 2 has been developed but we have v1...which was not so hardy.”

Scottish School (Mixed, non-fee paying)

“It would be nice to have more of them - be able to top them up - we have 6 and it's not enough for the class. We would like to buy them in if we could buy them in, we have budget. The only other thing is that they are vulnerable to heat damage from the light, that's the only issue we have.”

English School (Mixed, non-fee paying)

4.2 Pupil Survey

There are only 17 valid pupil responses providing feedback on the SCiA (referred to in the survey as Solar Cells Buggy).

All pupils who had used the solar buggy kits agreed with the statement ‘I enjoyed working with the solar cell buggy’, including 5/17 who strongly agreed.

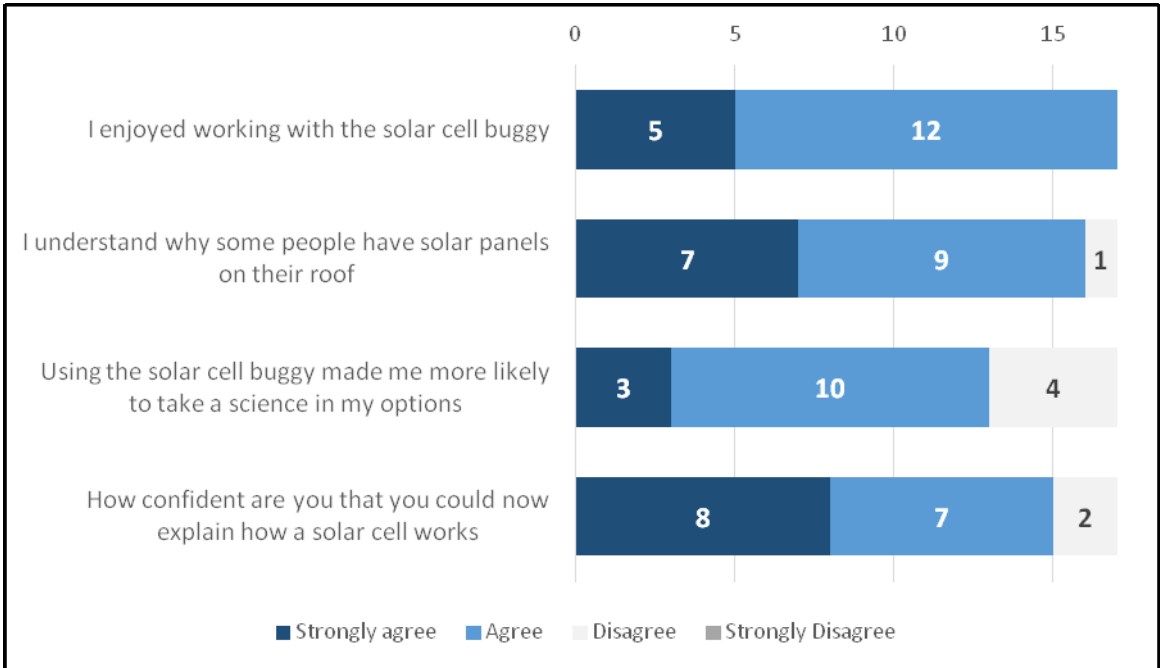
All but one pupil agreed with the statement ‘I understand why some people have solar panels on their roof’, including 7/17 who agreed strongly. Just one pupil-respondent who had experienced a lesson using the solar buggy kits indicated that they did not understand why people put solar panels on their roof.

Most pupils agreed that ‘Using the solar cell buggy made me more likely to take a science in my options’, including three who strongly agreed. Four out of seventeen pupils did not agree that using the solar buggy had had a positive effect on their likelihood of choosing science in their options.

When asked ‘How confident are you that you could now explain how a solar cell works’, 8 were ‘Very confident’, a further 7 were ‘Quite confident’, and just two were ‘Not very confident’.

Figure 15: Pupils’ Views on the SCiA Kit (counts)

Base: Pupils who used SCiA (17)



5 COLOUR VISION AND DISPLAYS TOPIC

This section provides results for the Colour Vision and Displays (CV&D) topic.

5.1 Teacher Survey

Four fifths (80%) of the schools responding to the survey stated that they had received a Colour Vision and Displays (CV&D) kit (Fig. 16). The remainder of the sub-section will use those that received the kit as a base.

Figure 16: Schools Receiving the CV&D Kit

Base: All respondents

	Yes	No	No response
Overall (%)	80	15	5
Scotland (counts)	53	10	-
England (counts)	37	7	-

Respondents were asked to indicate with which year groups the kit has been used. Teachers reported that they use the kit predominately with Y8/S2 and above, with just under a quarter (24%) stating that they use the kit with Y7/S1 (see Fig 17).

Figure 17: Year Group Use of the Kit

Base: Schools receiving the CV&D Kit (91)

	%
Y7/S1	24%
Y8/S2	58%
Y9/S3	44%
Other	41%

Teachers were asked how widespread the use of the kit had been to date. The CV&D kit has been used widely, with only 7% of respondents who had said they had received the kit, stating that they had not yet used it (see Fig.18). Nearly 4 in 10 (38%) stated that they had, in their view, used the CV&D kit with all appropriate classes, a further quarter (26%) stated that the kit had been used with most appropriate classes, and the same proportion again (26%) stated that the kit had been used with some appropriate classes.

Figure 18: Use with Appropriate Classes

Base: Schools receiving the CV&D Kit (91)

	%
All appropriate classes	38
Most appropriate classes	26
Some appropriate classes	26
Not yet used	7
D/K	2

Nearly six out of ten (59%) respondents who received the CV&D kit stated that the kit was embedded in their course, with a further third (34%) stating that the kit was not embedded. Seven percent did not state either way (see Fig 19).

Figure 19: Embeddedness of Kit

Base: Schools receiving the CV&D Kit (91)

	%
Yes	59
No	34
Not stated	7

When asked to provide open text comments about embedding the kits in their course, teachers provide a wide range of views regarding both the use and the embeddedness of the kits.

“It will be soon if not already - we need to advertise...fibre optics is a bit complicated. 3 LEDS that you can mix colour with is very good, colour disc is very good. Very nicely made.”
English School (Boys, non-fee paying)

“Lessons have been written as part of the curriculum using the kit.”
English School (Mixed, non-fee paying)

“The colour mixing wheels have been embedded into S2 courses and other parts of the kit used in S3 and S6.”
Scottish School (Mixed, non-fee paying)

“Use the displays part with S6 Adv Higher, but currently rehashing S3 course, so may find a slot for colour vision there.”
Scottish School (Mixed, non-fee paying)

For those that state that they have not yet embedded the kit, curriculum change and syllabus issues are cited as barriers.

“We are changing exam boards and re-writing SoL also updating our inventories to make sure all relevant practical apparatus is used as fully as we can.”
English School (Mixed, non-fee paying)

“Still getting to grips with curriculum change.”
Scottish School (Mixed, non-fee paying)

“Colour is outside our GCSE syllabus so we teach it in Year 7. Kit is helpful.”
English School (Boys, fee paying)

“It’s a KS3 topic and we don’t (yet) have any KS3 students.”
English School (Mixed, non-fee paying)

“We use it every year with all students, we have embedded it in the scheme of work we follow for the topic of light at KS3.”
English School (Mixed, non-fee paying)

“Many of the concepts in this kit we have found a bit difficult for younger pupils.”
Scottish School (Mixed, non-fee paying)

As for the SCiA kit, respondents were asked to what degree they felt the CV&D kit had an impact upon particular learning outcomes. Figure 20 illustrates the results. The vast majority of teachers indicated that the CV&D kit had an impact on all four learning outcomes in question. When asked whether the CV&D kit ‘enhanced knowledge/understanding of science principles’ 76% stated that it did to a great (35%) or to some (41%) degree. A further 8% stated that it enhanced this aspect of learning while only 1% stated that it did not have this impact at all. 15% stated that they did not know. With regard to the learning outcome ‘enhanced knowledge/understanding of the *application* of science principles’, 7 in 10 stated (70%) that the CV&D kit had an impact to a great (26%) or to some (44%) degree. Two percent stated that it did not have this impact at all.

As with all the kits, teachers were less likely to agree that the CV&D kit had an impact on skills development, with 15% stating it did not have this impact at all. One explanation provided by several teachers during telephone interviews was because there were too few kits for a whole classroom of pupils.

A high proportion of teachers agreed that the CV&D kit ‘enhanced motivation for science’, with nearly 9 in 10 (86%) teachers agreeing it had some impact, from ‘a great degree’ to ‘a little’.

Figure 20: Teachers’ Views on Learning Outcomes for Pupils

Base: Schools receiving the CV&D Kit (91)

	Great degree	Some degree	A little	Not at all	DK
	%	%	%	%	%
Enhanced knowledge/understanding of science principles	35	41	8	1	15
Enhanced knowledge/understanding of the application of science principles	26	44	14	2	13
Skills development	8	31	33	15	13
Enhanced motivation for science	18	48	20	2	12

School and teacher outcomes were explored with respondents being asked to what, if any, degree the CV&D kit had an impact. As with the SCiA kit, three quarters of teachers (75%) who responded stated that it enhanced the ability of teachers to design more exciting lessons to a ‘great degree’ (31%) or to ‘some degree’ (44%). Five percent stated that it didn’t have that outcome at all in their school.

Another positive result was obtained regarding the impact of the CV&D kit on teacher confidence in the classroom, with 16% stating that the kit had enhanced teacher confidence to a ‘great degree’, and nearly half (49%) stating that it had to ‘some degree’, with a further 11% stating it had to a ‘little degree’. In total, over three quarters (76%) stated the kit had had an impact on teacher confidence.

As discussed above (3.1) only 8% of respondents to a dichotomous question, indicated that more students were choosing science options as a result of the OEC programme. This scale question in which teachers were asked whether the CV&D kit had a similar impact, a more positive and nuanced picture emerges. One in five (20%) respondents indicated that more students were taking at least one science in their options as an outcome from the CV&D to a great (4%) to some (15%) or to a little (1%) degree. Over one in three respondents (31%) stated that it did not have that outcome at all, and a further third (33%) stated that they did not know.

Figure 21: Teachers' Views on Outcomes for Teachers and/or the School

Base: Schools receiving the CV&D Kit (91)

	Great degree	Some degree	A little	Not at all	DK
	%	%	%	%	%
More students taking at least one science in their options	4	15	1	31	33
Ability to design more exciting lessons	31	44	10	1	14
Enhanced teacher confidence in the classroom	16	49	11	7	16

Teachers who had received the CV&D kit were asked an open question about how teaching experiences using the kit could be improved, 25 teachers responded with a range of open text views which have been backcoded into main themes, as illustrated in Figure 22.

Figure 22: Open Text Responses to Potential Improvements to CV&D Kit (counts)

Base: Teachers providing open text (28)

Improvements	No.
Changes to the design	7
No improvements required	6
Provision of more kits to use in class	4
Easier sourcing of replacements/parts	4
More lesson resources/better instructions for students	3

The respondents were asked to complete the phrase 'Learning/teaching experiences using the IC kit could be improved if...'

"Adapted for more hands on work by pupils rather than demonstrations?"
Scottish School (Mixed, non-fee paying)

"I got it out with the science club again and they were enthralled - I enhanced by using colour filters. I think as a piece of kit it is fab."
English School (Mixed, non-fee paying)

"It included a set of appropriate filter glasses. As it happened we had to buy the filter glasses and match the colours on the power point to the colours of the filters because there were some differences in the primary colours between PowerPoint and glasses."
English School (Mixed, non-fee paying)

"The colour wheel was bigger."
English School (Mixed, non-fee paying)

"Someone could trawl through all the new learning opportunities and flag up possible areas for use."
Scottish School (Mixed, non-fee paying)

"It's just a shame this kit is so expensive. It's fantastic and we'd have more if we could afford it."
Scottish School (Mixed, non-fee paying)

"They work very well....we used to use overhead projectors. Not really any ideas on how it could be improved....really well designed, really well built, NEED MORE QUANTITY. If I were starting again I would do a few things a bit more simply - and more available 10 to school rather than 4."
English School (Girls, non-fee paying)

5.2 Pupil Survey Responses

In total 54 pupils gave feedback on the Colour Vision and Displays Kit including colour filters and Newton's spinning colour wheel.

All but one pupil who had used the CV&D kit agreed with the statement 'I enjoyed learning with the colour filters', including 26/54 who strongly agreed. Just one pupil disagreed with the proposition that learning with colour filters had been enjoyable.

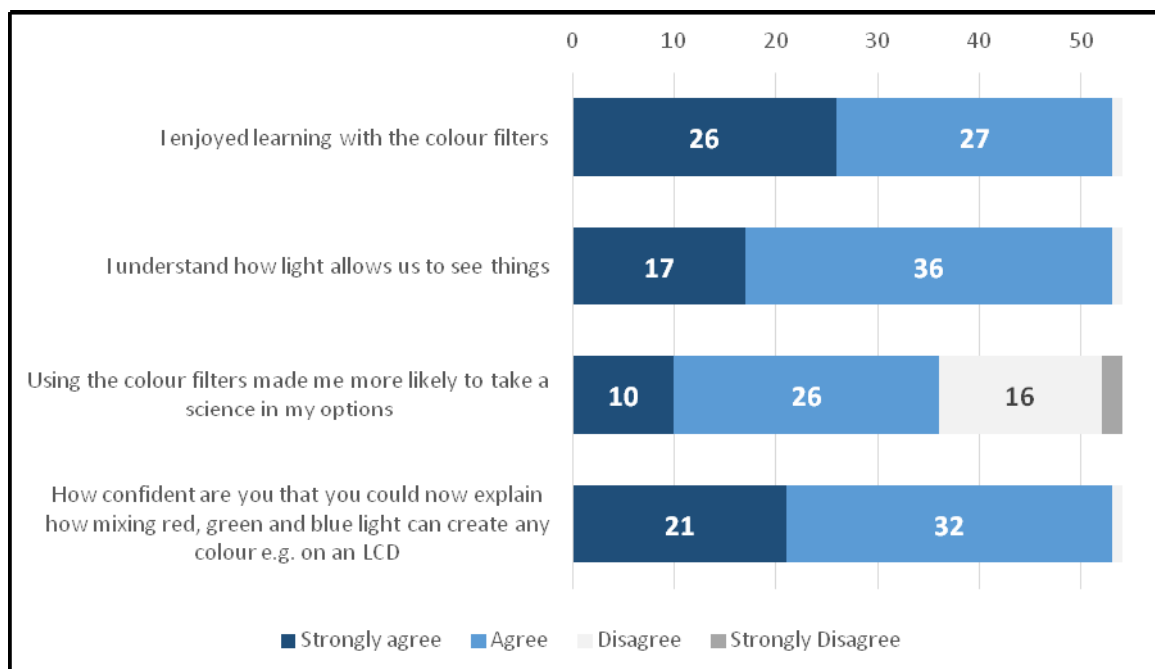
After using the CV&D kit, all but one pupil agreed with the statement 'I understand how light allows us to see things', including 17/54 who agreed strongly.

Overall, two thirds (36/54) of pupils agreed that using the colour filters made them more likely to take a science in their options, including ten who strongly agreed that the experience of using the CV&D kit made them more likely to select a science option. Two out of 54 pupils who used the CV&D kit strongly disagreed that it would make them more likely to take a science option.

When asked 'How confident are you that you could now explain how mixing red, green and blue light can create any colour e.g. on an LCD', 21 pupils were 'Very confident', a further 32 were 'Quite confident', and just one was 'Not very confident'.

Figure 23: Pupils' Views on the CV&D Kit (Counts)

Base: Pupils who used the CV&D Kit (54)



6 ILLUMINATION AND COMMUNICATION TOPIC

This section provides results for the Illumination and Communication (IC) topic.

6.1 Teacher Survey

Three fifths (61%) of the schools responding to the survey stated that they had received an Illumination and Communication (IC) kit (see Fig.24). The remainder of the sub-section will use those that received the kit as a base.

Figure 24: Schools Receiving the IC Kit

Base: All respondents

	Yes	No	No response
Overall (%)	61	31	8
Scotland (counts)	38	24	
England (counts)	32	11	

Respondents were asked to indicate with which year groups the kit has been used. The results indicate that the higher the year group within the range, the higher the proportion of schools indicate that they use the kit with that year group (see Fig 25). Six in ten respondents stated that they used the kit with year groups other than Y7/S1 to Y9/S3. In telephone interviews, it was made clear that 'other' was sixth form.

Figure 25: Year Group Use of the Kit

Base: Schools receiving the IC Kit (70)

	%
Y7/S1	10
Y8/S2	17
Y9/S3	26
Other	60

When asked how widespread the use of the kit had been to date, nearly one quarter (23%) of respondents who had received the IC kit stated that they had not yet used it (see Fig.26). Only 14% stated that they had used the IC kit with all appropriate classes, but a further quarter (24%) stated that the kit had been used with most appropriate classes, and 37% stated that the kit had been used with 'some appropriate classes'.

Figure 26: Use with Appropriate Classes

Base: Schools receiving the IC Kit (70)

	%
All appropriate classes	14
Most appropriate classes	24
Some appropriate classes	37
Not yet used	23
D/K	1

Over four out of ten (41%) respondents who received the IC kit stated that the kit was embedded in their course, with a further third (40%) stating that the kit was not embedded. Nearly one fifth (19%) did not state either way (see Fig 27).

Figure 27: Embeddedness of Kit

Base: Schools receiving the IC Kit (70)

	%
Yes	41
No	40
Not stated	19

Respondents were asked to provide open text comments about embedding the kits in their course, some of which are provided below.

- “LED kits used by S5 & 6 pupils for experiment to measure Planck’s Constant.”*
Scottish School (Mixed, non-fee paying)
- “Only for Year 12/13 Applied group.”*
English School (Mixed, non-fee paying)
- “Again, was embedded in SG course but not (yet) in Nat 5. Is embedded in BGE, S1 topic on light.”*
Scottish School (Mixed, non-fee paying)
- “Yes, we use at a specific part of the course and to consolidate theory.”*
English School (Mixed, non-fee paying)

Some teachers described the barriers to embedding the kit.

- “Training for teachers within school is needed as the kit is complex.”*
English School (Mixed, non-fee paying)
- “I have made extensive use of the kit but it is not used by all teachers. Perhaps with new Added Value units in CfE it might be used more.”*
Scottish School (Mixed, non-fee paying)
- “Still getting to grips with curriculum change.”*
Scottish School (Mixed, non-fee paying)
- “Trickiest set of all to use. Specialists have used it, not everyone in Science faculty.”*
Scottish School (Mixed, non-fee paying)

Figure 28 illustrates the responses that respondents provided when asked to what degree they felt the IC kit had an impact upon various learning outcomes. Of those respondents who gave a view, the vast majority indicated that the IC kit had an impact on all four learning outcomes. When asked whether the IC kit ‘enhanced knowledge/understanding of science principles’ 71% stated that it had an impact to a great (23%), to some (34%) degree, or a little (14%). Only 1% stated that it did not have this impact at all. 27% stated that they did not know, reflecting the high proportion of those who had not yet used the kits. With regard to the learning outcome ‘enhanced knowledge/understanding of the application of science principles’, 71% stated that the IC kit had an impact to a great (27%), to some (30%), or to a little (14%) degree. One percent stated that it did not have this impact at all.

As with all the kits, teachers were slightly less likely to indicate that the IC kit had an impact on skills development, with 6% stating it did not have this impact at all. However, nearly 7 in 10 (69%) teachers indicated that the kit had enhanced skills development to some degree.

A high proportion of teachers agreed that the IC kit ‘enhanced motivation for science, with 7 in 10 (70%) teachers agreeing it had some impact, from ‘a great degree’ to ‘a little’. Three percent stated that it did not have this effect.

Figure 28: Teachers’ Views on Learning Outcomes for Students

Base: Schools receiving the IC Kit (70)

	Great degree	Some degree	A little	Not at all	DK
	%	%	%	%	%
Enhanced knowledge/understanding of science principles	23	34	14	1	27
Enhanced knowledge/understanding of the application of science principles	27	30	14	1	27
Skills development	20	30	19	6	26
Enhanced motivation for science	16	37	17	3	27

Respondents were asked to what, if any, degree three outcomes for teachers and/or the school have resulted from using the IC kit.

A small proportion (8%) of respondents indicated in a dichotomous question that more students were choosing science options as a result of the OEC programme overall (see 3.1 above). However in scale questions regarding the impact of individual kits, a much more positive picture emerges and the same is true of the IC kit (see Fig 29 below). One third (38%) of respondents indicated that more students were taking at least one science in their options as an outcome of the IC kit to a great (1%) to some (9%) or to a little (23%) degree. Around one quarter of respondents (24%) stated that it did not have that outcome at all, and a further four in ten (43%) stated that they did not know.

Two thirds (68%) of teachers stated that the IC kit enhanced the ability of teachers to design more exciting lessons to a great (16%), to some (41%) or to a little (11%) degree. Four percent stated that the kit didn’t produce this outcome.

Nearly 6 in 10 teachers (59%) thought that the IC kit enhanced teacher confidence in the classroom, with 13% stating that the kit had enhanced teacher confidence to a ‘great degree’, a third (33%) stating that it had to ‘some degree’, with a further 13% stating it had to a ‘little degree’. One in 10 (10%) stated that the kit had had no impact on teacher confidence.

Figure 29: Teachers’ Views on Outcomes for Teachers and/or the School

Base: Schools receiving the IC Kit (70)

	Great degree	Some degree	A little	Not at all	DK
	%	%	%	%	%
More students taking at least one science in their options	1	9	23	24	43
Ability to design more exciting lessons	16	41	11	4	27
Enhanced teacher confidence in the classroom	13	33	13	10	31

Teachers were asked an open question about how teaching experiences using the IC kit could be improved, 28 teachers responded with a range of open text views which have been backcoded into themes as illustrated in Figure 30.

Figure 30: Open Text Responses to Potential Improvements to CV&D Kit (counts)

Base: Teachers providing open text (28)

Improvements	No.
No improvements required	9
Provision of more kits to use in class	7
Changes to the design	5
More lesson resources/better instructions for students	4

The respondents were asked to complete the phrase ‘Learning/teaching experiences using the Colour Vision and Displays kit could be improved if...’

“Kits were made up. We need to get around to doing this for what we have been given. One demo is not enough.”

Scottish School (Mixed, non-fee paying)

“Sources and suppliers of the components so replacements can be easily sourced.”

Scottish School (Mixed, non-fee paying)

“Easier way of powering than with battery packs? Perhaps a ready-made slot-in connection for LEDs.”

English School (Mixed, fee paying)

“A longer fibre to demonstrate communication over distance and a sound to light converter.”

Scottish School (Mixed, non-fee paying)

“There was a greater range of LEDs and if they had a narrower wave length range. Similarly with circles former, both would extend the range of the independent variable.”

Scottish School (Mixed, non-fee paying)

“This was the most disappointing kit in terms of reliability and use - hence not used.”

English School (Boys, fee paying)

“We had enough sets, we have 26 pupils so 5 are insufficient.”

English School Mixed, non-fee paying)

“Not sure if it could be improved. Very good kit and activities.”

Scottish School (Mixed, non-fee paying)

“I think really highly of it - useful for the application and understanding.”

English School (Mixed, non-fee paying)

6.2 Pupil Survey

A total of 38 pupils gave feedback on the Illumination and Communication (IC) kit including LED and halogen lights with hand-cranked generator.

All but two pupils who had used the IC kit agreed with the statement ‘I enjoyed learning with LEDs and optical fibres’, including 9/39 who strongly agreed.

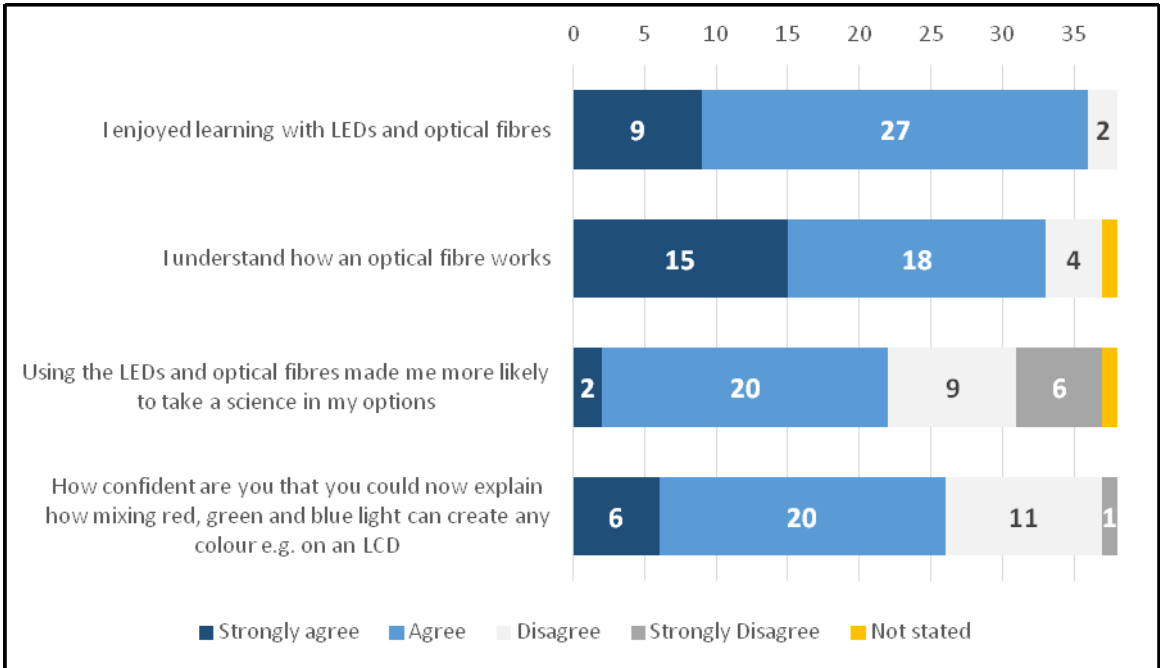
After using the IC kit, most pupils agreed with the statement 'I understand how an optical fibre works', including 15/38 who agreed strongly. Four pupils disagreed and one chose not to answer this question.

Three fifths of pupils agreed that the kits made them more likely to take a science in their options, including two who strongly agreed that the experience of using the LEDs and optical fibres made them more likely to select a science option. Fifteen pupils disagreed, including six who disagreed strongly. One pupil did not answer this question.

When asked 'How confident are you that you could now explain how an LED uses less power' seven in ten pupils expressed confidence: 6 were 'Very confident', and a further 20 were 'Quite confident'. Eleven pupils were 'Not very confident' and one student was 'Not at all confident' that they could explain how an LED uses less power.

Figure 31: Pupils' Views on the IC Kit (Counts)

Base: Pupils who used the IC Kit (38)



7 HUMAN VISION

This section provides results for the Human Vision (HV) topic.

7.1 Teacher Survey

Human Vision kits have been made available as an alternative to the Colour Vision and Displays kit for schools in England since March 2012. Eight English schools (12%) provided feedback on the CVD kit through the teacher survey.

None of the schools responding to the survey reported having used the Human Vision kit with all or 'most' appropriate classes, 5 stated that they had used it with 'some appropriate classes' and 3 stated that they had not yet used the kit with students. As Human Vision kits have only been available to schools for one complete academic year, it is not surprising that no schools felt that the Human Vision kit had yet become embedded into their course.

Four schools indicated that the Human Vision kit had been used with Y8, 1 school had used the kit with Y9, and 3 schools indicated that they had not yet used their kits with students.

When asked whether the HV kit 'enhanced knowledge/understanding of science principles' three stated that it had some impact and one said it had a little impact (four felt unable to comment at this point). With regard to the learning outcome 'enhanced knowledge/understanding of the *application* of science principles', 3 schools stated that the HV kit had some impact, one said it had a little impact and 3 did not comment.

When asked whether the Human Vision kit had an impact on skills development, two schools said 'some' and two said 'a little'. Four felt unable to comment.

Three teachers felt that the Human Vision kit 'enhanced motivation for science' in their school 'to some degree', and one teacher felt it enhanced motivation 'a little'.

Figure 32: Teachers' Views on Learning Outcomes for Students (Counts)

Base: Schools receiving the HV Kit (8)

	Great degree	Some degree	A little	Not at all	DK
Enhanced knowledge/understanding of science principles	0	3	1	0	4
Enhanced knowledge/understanding of the application of science principles	0	4	1	0	3
Skills development	0	2	2	0	4
Enhanced motivation for science	0	3	1	0	4

Respondents were asked to what, if any, degree three outcomes for teachers and/or the school have resulted from using the Human Vision kit.

Only three teachers gave an answer regarding whether the HV kit enhanced the ability of teachers to design more exciting lessons, but all three felt it did 'to some degree'. The same three teachers indicated that the HV kit enhanced teacher confidence in the classroom to 'some degree'.

Teachers were asked an open question about how teaching experiences using the Human Vision kit could be improved, the following comments were received:

"You could use old glasses/spectacles to show how vision is altered."

English School (Mixed, non-fee paying)

“The monitor was easily linked to the LED camera. The only method of using the camera was directly through the projector, not ideal.”

English School (Girls, fee paying)

“It would be nice to have class set of some of the equipment.”

English School (Girls, fee paying)

7.1 Pupil Survey

No pupil survey responses were received from English schools that had received the Human Vision kits, hence no pupil feedback is available for this kit.

8 CONCLUSIONS AND RECOMMENDATIONS

The evaluation results show the OEC Curriculum Initiative has produced broadly positive results for teachers and, in teachers' opinions, for pupils.

Overwhelmingly positive results are evident for:

- All four individual kits and their
 - o Impact on teachers
 - o Impact on pupils (NB. with variable results for choosing science options)
- Training (CPD) sessions
- The OEC Curriculum Initiative overall (qualitative feedback).

Less positive results were seen for:

- Increased take-up of science as a result of the OEC Curriculum Initiative
- Website use
- With an additional issue of non-receipt of kits.

Inconclusive results were displayed for:

- Embeddedness of kits into courses.

The overwhelming majority of open text (qualitative) responses received were positive, with high praise received particularly for the quality of the kits and their use in the classroom. Constructive and positive comments were also provided by teachers in response to being asked what could be done to improve the OEC initiative.

Any negative feedback received through the qualitative and the quantitative results centre mainly around 2 areas: non- or late arrival of kits and, in a few cases, the quality of kits. In the case of the latter, the negative feedback is more than outweighed by unprompted comments about the high quality of kits. The evidence seems to indicate that earlier kits might not have been as robust as later kits.

The evaluation has found that the OEC training and support materials were welcomed by teachers. The majority (66%) felt that the CPD sessions were 'invaluable' or of 'significant use'. However other support materials were less widely used and were less frequently assessed to be invaluable or of significant use: 32% for the CD and/or paper-based resources and 20% for the website. This suggests that tangible/hard-copy support materials had the greatest impact, and some comments were received about difficulties accessing the website.

Explanatory comments made by teachers suggested that more could be done to publicise and promote the support materials, not only at the training sessions or with the kit packages, but also through the development of an online community for further discussion of the kits, associated lesson plans and so on. This type of development would encourage teachers to explore the use of kits in the contexts of changing curriculum requirements, another issue raised by some, mostly Scottish, teachers.

It has also been suggested that the OEC could help teachers by sending out emails from time to time with additional suggestions: of course, this would require teachers to provide accurate direct email addresses at the point of training (many to date have opted for providing a school office email address, which frequently results in messages not reaching the intended recipient), and add the burden of keeping contacts updated when email formats are changed or teachers move school.

Teachers welcomed the training opportunities to network and to develop new ideas, and they were also highly positive about the 'joined-up' nature of the OEC curriculum initiative in its delivery of training and kits with additional resources. Many felt that OEC had plugged a gap that existed for well-designed specialist equipment that was suitable for hands-on use by pupils to bring optoelectronic concepts to life. They also commented upon the value of receiving training and practical suggestions for teaching up-to-date optoelectronics applications, increasing their own knowledge and confidence, capturing pupils' interest in the subject, understanding of the concepts and understanding of the wide range of career possibilities that knowledge of these topics can open up for them.

Teachers provided little evidence that the OEC had a positive impact upon take-up of science subjects for GCSE/Standard Grades or more advanced courses. However this was often explained by comments that all pupils are required to study science to GCSE/Standard Grades. In addition, it seemed teachers were reluctant to apportion such clear cause and effect to a relatively recent change within their school which affects only selected topics within science tuition and/or attributing an effect to the OEC project when many variables will have an influence on pupil choice. Teachers were more inclined to attribute a higher likelihood of pupils choosing science options to the OEC curriculum in more modulated questions.

Pupils tended to report a positive response to lessons using OEC kits, and the most common statements selected to reflect their experience of the optoelectronics topics they had been taught were 'I want to do more work like this' and 'It made me think'.

Teachers provided constructive suggestions on how use of the kits could be improved, in response to a question about potential improvements. Again, very positively, a significant proportion of teachers stated that no improvements are required, or that a positive change would be the provision of more kits for use in class. Suggestions made by teachers in addition to these two types of response include:

- additional resources for use in class/or preparation
- easier sourcing of replacements or replacement parts
- changes in design (various).

It was hard to ascertain whether comments made on additional resources were made in the knowledge of the resources on the website.

The evaluation found that where the kits had not been used the main cause was teacher turnover, and to a much lesser extent, due to changes in curriculum. In some cases, when teachers had left school, kits had been stored and were 'not available'; in other cases, new teachers did not feel able to use the kits because of lack of training/handover.

There are no easy solutions to combat the issue of sustainability of kit use through teacher turnover. Our recommendations are contingent on continued funding and/or additional human resource to the project:

- Top up training sessions with invitations sent to all schools, priority given to new teachers in the schools
- Maintenance of a schools database to contact new teachers to:
 - o Direct them to website resources
 - o Ascertain their training needs.

The evaluators understand that the OEC is committed to providing kits to those who have not received them. Some small-scale investigation should be undertaken to understand why this small number of kits were not sent after training had taken place.

Most of the unprompted comments from teachers to open questions are extremely positive. Many ask for more kits to enable their students to be hands on, or to buy additional kits/spare parts. We recommend that the website points teachers/technicians to either an OEC shop, selling both full kits and replacement parts, or to suppliers of spare parts.

APPENDIX 1 – SCOTTISH TEACHER QUESTIONNAIRE



OPTOELECTRONIC COLLEGE CURRICULUM KITS EVALUATION

Dear Colleague,

According to our records your school has received at least one of three curriculum kits and associated training from the Optoelectronic College (OEC). These are:

- Solar cells in action
- Colour vision and displays
- Illumination and communication

Your school is invited to participate in a national evaluation to assess the impact of this OEC initiative on science education and learning. If you are unfamiliar with the use of this/these kits then perhaps you could direct this communication to a colleague in the science team who has used the kits. Your views and comments are extremely important to us as this evaluation will inform decisions on the funding, design and operation of such schemes in the future.

Following advice from the Institute of Physics, we have commissioned James Lambley & Associates to undertake the independent evaluation on our behalf. If you have any questions about the evaluators, or wish to check their bona fides, please contact me at [EMAIL ADDRESS] If you have questions about completing the questionnaire, please contact James Lambley & Associates Ltd through JamesLambley@outlook.com.

The questionnaire will take no more than 10-15 minutes to complete. Please return the completed questionnaire, in the postage paid envelope provided, to the evaluators within **2 weeks** of returning from half term

The evaluators will ensure the anonymity of yourself and your school. Neither school names nor participants will be passed to us. This data is collected so the evaluators telephone only those who have not returned their questionnaires, to ask them to participate. We would greatly appreciate your help in completing this evaluation despite your very busy schedules.

Yours faithfully,



Professor I. A. Shanks
Founder of the OEC

Optoelectronics Equipment and Materials Feedback

The first two questions are included to help us understand whether teachers in different types of school have differing experiences of using the curriculum kits. While the responses you give will be treated as confidential and the anonymity of yourself and the school will be protected, we would be grateful if you could write your school name and town in the box below so that the research team don't send reminders after you respond.

This questionnaire contains blocks of questions about the kits. The maximum number of blocks of questions that will apply to any school will be three, and for many schools, fewer.

BLOCK A: ABOUT YOUR SCHOOL

A1 Is your school...?

Single sex - girls

Single sex - boys

Mixed

A2 Is your school...?

Non-fee paying

Fee paying

Please complete the following three paragraphs about the OEC initiative as you think best.

A3 The best things about the OEC curriculum initiative are...

A4 The OEC work can be improved by...

A5 The most significant impact on pupil learning has been...

A6 Have you perceived an increase in pupils choosing science subjects amongst their course options after the use of the kits?

Yes

No

No Change (e.g. students have to take science)

BLOCK B: SOLAR CELLS IN ACTION (BUGGY KIT)

B1 Has your school received the Solar Cells (SC) kit? Yes Continue to B2
No Skip to Block C

B2 When did your school receive training for the SC kit?
 Please tell us the academic year (& term if known).

B3 How often has the Solar Cells kit been used...

with all appropriate classes/groups

with most appropriate classes/groups

with some appropriate classes/groups

Not used yet

B4 With which year groups has the Solar Cells kit been used?
 Tick all that apply

	S1	S2	S3	Other
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

B5 Would you say that the use of the Solar Cells kit is embedded in your course(s)?

Yes <input type="checkbox"/>	No <input type="checkbox"/>
------------------------------	-----------------------------

Comments about embedding the kit in your course

B6 To what degree do you feel the following learning outcomes for students have resulted from using this Solar Cells kit?

	To a great degree	To some degree	A little	Not at all
Enhanced knowledge and/or understanding of science principles	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Enhanced knowledge and/or understanding of the <i>application</i> of science principles	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Skills development	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Enhanced motivation for science	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Something else (please describe)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

B7 To what degree do you feel the following outcomes for teachers and/or the school have resulted from using this Solar Cells kit?

	To a great degree	To some degree	A little	Not at all
More students taking at least one science in their options	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ability to design more exciting lessons	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Enhanced teacher confidence in the classroom	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Something else (please describe)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

B8 Please complete the following paragraph:

Learning/teaching experiences using the Solar Cells kit could be improved if...

BLOCK C: COLOUR VISION AND DISPLAYS KIT

C1 Has your school received the Colour Vision and Displays (CVD) kit? Yes Continue to C2
No Skip to Block D

C2 When did your school receive training for the CVD kit? Please tell us the academic year (& term if known).

C3 How often has the Colour Vision and Displays kit been used...

- With all appropriate classes/groups
- With most appropriate classes/groups
- With some appropriate classes/groups
- Not used yet

C4 With which year groups has the Colour Vision and Displays kit been used? Tick all that apply

S1	S2	S3	Other
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

C5 Would you say that the use of the Colour Vision and Displays kit is embedded in your course(s)? Yes No

Comments about embedding the kit in your course

C6 To what degree do you feel the following learning outcomes for students have resulted from using this Colour Vision and Displays kit ?

	To a great degree	To some degree	A little	Not at all
Enhanced knowledge and/or understanding of science principles	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Enhanced knowledge and/or understanding of the <i>application</i> of science principles	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Skills development	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Enhanced motivation for science	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Something else (please describe)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

C7 To what degree do you feel the following outcomes for teachers and/or the school have resulted from using this Colour Vision and Displays kit?

	To a great degree	To some degree	A little	Not at all
More students taking at least one science in their options	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ability to design more exciting lessons	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Enhanced teacher confidence in the classroom	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Something else (please describe)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

C8 Please complete the following paragraph:

Learning/teaching experiences using the Colour Vision and Displays kit could be improved if...

BLOCK D: ILLUMINATION AND COMMUNICATION

D1 Has your school received the Illumination and Communication (IC) kit? Yes Continue to D2
No Skip to Block E

D2 When did your school receive training for the IC kit? Please tell us the academic year (& term if known).

D3 How often has the Illumination and Communication kit been used

With all appropriate classes/groups

With most appropriate classes/groups

With some appropriate classes/groups

Not used yet

D4 With which year groups has the Illumination and Communication kit been used? Tick all that apply

S1	S2	S3	Other
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

D5 Would you say that the use of the Illumination and Communication kit is embedded in your course(s)? Yes No

Comments about embedding the kit in your course

D6 To what degree do you feel the following learning outcomes for students have resulted from using this Illumination and Communication kit?

	To a great degree	To some degree	A little	Not at all
Enhanced knowledge and/or understanding of science principles	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Enhanced knowledge and/or understanding of the <i>application</i> of science principles	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Skills development	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Enhanced motivation for science	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Something else (please describe)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

D7 To what degree do you feel the following outcomes for teachers and/or the school have resulted from using this Illumination and Communication kit?

	To a great degree	To some degree	A little	Not at all
More students taking at least one science in their options	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ability to design more exciting lessons	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Enhanced teacher confidence in the classroom	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Something else (please describe)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

D8 Please complete the following paragraph:

Learning/teaching experiences using the Illumination & Communication kit could be improved if...

BLOCK E: OVERALL IMPACT OF OEC KITS AND TRAINING

The OEC initiative offered CPD training, website support, and paper and CD based resources.

E1 We are interested in how useful these resources have been.

	Not used	Of limited use	Of some use	Of significant use	Invaluable
CPD sessions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Website materials	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CD/paper resources	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

E2 Do you have any additional comments to make about the resources?

As part of this evaluation, it is important that we collect the views and experiences of students who have taken part in lessons using the OEC curriculum kits. We are seeking a number of schools in which 20-30 students in S1 to S3 will complete a very simple (two sides of A4) questionnaire about their experiences of lessons using the OEC kits.

A pre-paid postage envelope will be provided for completed questionnaire packs to be returned.

E3 Please tick the box on the left if you would be prepared to help with the student survey, and write in your name and any specific addressing details we would require for sending the student questionnaire pack to you/your colleague.

Thank you.

Name:
Postal address:

If you would like to make additional comments about the kits and/or training please use an additional sheet and append to the questionnaire.

THANK YOU FOR COMPLETING THIS EVALUATION QUESTIONNAIRE
PLEASE RETURN IT TO THE INDEPENDENT EVALUATORS,
JAMES LAMBLEY & ASSOCIATES LTD JamesLambley@outlook.com OR POST TO
UNIT 5A, WEST VIEW, LITTLETHORPE, RIPON, NORTH YORKS, HG4 3LN.

APPENDIX 2 – ENGLISH TEACHER QUESTIONNAIRE



OPTOELECTRONIC COLLEGE CURRICULUM KITS EVALUATION

Dear Colleague,

According to our records your school has received at least one of four curriculum kits and associated training from the Optoelectronics College (OEC). These are:

- Solar cells in action
- Colour vision and displays
- Illumination and communication
- Human vision

Your school is invited to participate in a national evaluation to assess the impact of this OEC initiative on science education and learning. If you are unfamiliar with the use of this/these kits, then perhaps you could direct this communication to a colleague in the science team who has used the kits. Your views and comments are extremely important to us as this evaluation will inform decisions on the funding, design and operation of such schemes in the future.

Following advice from the Institute of Physics, we have commissioned James Lambley & Associates to undertake the independent evaluation on our behalf. If you have any questions about the evaluators, or wish to check their bona fides, please contact me [EMAIL] at If you have questions about completing the questionnaire, please contact James Lambley & Associates Ltd through JamesLambley@outlook.com.

The questionnaire will take no more than 10-15 minutes to complete. Please return the completed questionnaire, in the postage paid envelope provided, to the evaluators within **2 weeks** of returning from half term

The evaluators will ensure the anonymity of yourself and your school. Neither school names nor participants will be passed to us. This data is collected so the evaluators telephone only those who have not returned their questionnaires, to ask them to participate. We would greatly appreciate your help in completing this evaluation despite your very busy schedules.

Yours faithfully,

Professor I. A. Shanks
Founder of the OEC

Optoelectronics Equipment and Materials Feedback

The first two questions are included to help us understand whether teachers in different types of school have differing experiences of using the curriculum kits. While the responses you give will be treated as confidential and the anonymity of yourself and the school will be protected, we would be grateful if you could write your school name and town in the box below so that the research team don't send reminders after you respond.

This questionnaire contains four blocks of questions about the kits. The maximum number of blocks of questions that will apply to any school will be three, and for many schools, fewer.

BLOCK A: ABOUT YOUR SCHOOL

A1 Is your school...?

Single sex - girls

Single sex - boys

Mixed

A2 Is your school...?

Non-fee paying

Fee paying

Please complete the following three paragraphs about the OEC initiative as you think best.

A3 The best things about the OEC curriculum initiative are...

A4 The OEC work can be improved by...

A5 The most significant impact on pupil learning has been...

A6 Have you perceived an increase in pupils choosing science subjects amongst their course options after the use of the kits?

Yes

No

No Change (e.g. students have to take science)

BLOCK B: SOLAR CELLS IN ACTION (BUGGY) KIT

B1 Has your school received the Solar Cells (SC) kit? Yes Continue to B2
No Skip to Block C

B2 When did your school receive training for the SC kit?
 Please tell us the academic year (& term if known).

B3 How often has the Solar Cell kit been used...
 with all appropriate classes/groups
 with most appropriate classes/groups
 with some appropriate classes/groups
 Not used yet

B4 With which year groups has the Solar Cell kit been used?
 Tick all that apply Y7 Y8 Y9 Other

B5 Would you say that the use of the Solar Cell kit is embedded in your course(s)?
Yes No

Comments about embedding the kit in your course

B6 To what degree do you feel the following learning outcomes for students have resulted from using this Solar Cell kit?

	To a great degree	To some degree	A little	Not at all
Enhanced knowledge and/or understanding of science principles	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Enhanced knowledge and/or understanding of the <i>application</i> of science principles	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Skills development	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Enhanced motivation for science	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Something else (please describe)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

B7 To what degree do you feel the following outcomes for teachers and/or the school have resulted from using this Solar Cell kit?

	To a great degree	To some degree	A little	Not at all
More students taking at least one science in their options	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ability to design more exciting lessons	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Enhanced teacher confidence in the classroom	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Something else (please describe)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

B8 Please complete the following paragraph:

Learning/teaching experiences using the Solar Cell kit could be improved if...

BLOCK C: COLOUR VISION AND DISPLAYS KIT

C1 Has your school received the Colour Vision and Displays (CVD) kit? Yes Continue to C2
No Skip to Block D

C2 When did your school receive training for the CVD kit? Please tell us the academic year (& term if known).

C3 How often has the Colour Vision and Displays kit been used...
 With all appropriate classes/groups
 With most appropriate classes/groups
 With some appropriate classes/groups
 Not used yet

C4 With which year groups has the Colour Vision and Displays kit been used? Tick all that apply

Y7	Y8	Y9	Other
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

C5 Would you say that the use of the Colour Vision and Displays kit is embedded in your course(s)? Yes No

Comments about embedding the kit in your course

C6 To what degree do you feel the following learning outcomes for students have resulted from using this Colour Vision and Displays kit?

	To a great degree	To some degree	A little	Not at all
Enhanced knowledge and/or understanding of science principles	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Enhanced knowledge and/or understanding of the <i>application</i> of science principles	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Skills development	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Enhanced motivation for science	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Something else (please describe)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

C7 To what degree do you feel the following outcomes for teachers and/or the school have resulted from using this Colour Vision and Displays kit?

	To a great degree	To some degree	A little	Not at all
More students taking at least one science in their options	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ability to design more exciting lessons	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Enhanced teacher confidence in the classroom	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Something else (please describe)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

C8 Please complete the following paragraph:

Learning/teaching experiences using the Colour Vision and Displays kit could be improved if...

BLOCK D: ILLUMINATION AND COMMUNICATION

D1 Has your school received the Illumination and Communication (IC) kit? Yes Continue to D2
No Skip to Block E

D2 When did your school receive training for the IC kit? Please tell us the academic year (& term if known).

D3 How often has the Illumination and Communication kit been used

With all appropriate classes/groups

With most appropriate classes/groups

With some appropriate classes/groups

Not used yet

D4 With which year groups has the Illumination and Communication kit been used? Tick all that apply

Y7	Y8	Y9	Other
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

D5 Would you say that the use of the Illumination and Communication kit is embedded in your course(s)? Yes No

Comments about embedding the kit in your course

D6 To what degree do you feel the following learning outcomes for students have resulted from using this Illumination and Communication kit?

	To a great degree	To some degree	A little	Not at all
Enhanced knowledge and/or understanding of science principles	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Enhanced knowledge and/or understanding of the <i>application</i> of science principles	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Skills development	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Enhanced motivation for science	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Something else (please describe)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

D7 To what degree do you feel the following outcomes for teachers and/or the school have resulted from using this Illumination and Communication kit?

	To a great degree	To some degree	A little	Not at all
More students taking at least one science in their options	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ability to design more exciting lessons	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Enhanced teacher confidence in the classroom	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Something else (please describe)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

D8 Please complete the following paragraph:

Learning/teaching experiences using the Illumination & Communication kit could be improved if...

BLOCK E: HUMAN VISION

E1 Has your school received the Human Vision (HV) kit? Yes Continue to E2
 No Skip to Block F

E2 When did your school receive training for the HV kit? Please tell us the academic year (& term if known).

E3 How often has the Human Vision kit been used...
 with all appropriate classes/groups
 with most appropriate classes/groups
 with some appropriate classes/groups
 Not used yet

E4 With which year groups has the Human Vision kit been used? Tick all that apply
 Y7 Y8 Y9 Other

E5 Would you say that the use of the Human Vision kit is embedded in your course(s)?
 Yes No

Comments about embedding the kit in your course

E6 To what degree do you feel the following learning outcomes for students have resulted from using this Human Vision kit?

	To a great degree	To some degree	A little	Not at all
Enhanced knowledge and/or understanding of science principles	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Enhanced knowledge and/or understanding of the <i>application</i> of science principles	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Skills development	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Enhanced motivation for science	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Something else (please describe)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

E7 To what degree do you feel the following outcomes for teachers and/or the school have resulted from using this Human Vision kit?

	To a great degree	To some degree	A little	Not at all
More students taking at least one science in their options	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ability to design more exciting lessons	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Enhanced teacher confidence in the classroom	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Something else (please describe)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

E8 Please complete the following paragraph:

Learning/teaching experiences using the Human Vision kit could be improved if...

BLOCK F: OVERALL IMPACT OF OEC KITS AND TRAINING

The OEC initiative offered CPD training, website support, and paper and CD based resources.

F1 We are interested in how useful these resources have been.

	Not used	Of limited use	Of some use	Of significant use	Invaluable
CPD sessions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Website materials	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CD/paper resources	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

F2 Do you have any additional comments to make about the resources?

As part of this evaluation, it is important that we collect the views and experiences of students who have taken part in lessons using the OEC curriculum kits. We are seeking a number of schools in which 20-30 students in Y7-9 will complete a very simple (two sides of A4) questionnaire about their experiences of lessons using the OEC kits.

A pre-paid postage envelope will be provided for completed questionnaire packs to be returned.

F3 If you or someone else at your school would be prepared to help with the student survey, please write in your name and any specific addressing details we would require for sending the student questionnaire pack to you/your colleague.

Thank you.

Name:

Postal address:

Name:

Postal address:

If you would like to make additional comments about the kits and/or training please use an additional sheet and append to the questionnaire.

THANK YOU FOR COMPLETING THIS EVALUATION QUESTIONNAIRE
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UNIT 5A, WEST VIEW, LITTLETHORPE, RIPON, NORTH YORKS, HG4 3LN.

APPENDIX 3 & 4 – PUPIL SURVEYS

Optoelectronics Equipment and Materials Feedback

Dear Student,

This short questionnaire is to ask you about science equipment designed to try to make your studies more interesting and to help your understanding in four areas of science (optoelectronics). We would be very grateful for your views on these pieces of equipment/materials. Your feedback will be used to see if more materials should be designed and put into more schools. Please answer the questions about any of the three areas you remember studying. Your answers are anonymous, so there's no need to write your name on this sheet.

BLOCK A: SOLAR CELLS IN ACTION



Q1 Have you used the solar cell and buggy? Yes Continue to Q2
No Skip to Block B

Q2 Please tick one box on each row to show how much you agree or disagree with the statement.

	Strongly Agree	Agree	Disagree	Strongly Disagree
I enjoyed working with the solar cell and buggy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I understand why some people have solar panels on their roof	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Using the solar cell and buggy made me more likely to take a science in my options	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q3 How confident are you that you could now... explain how a solar cell works

	Very confident	Quite confident	Not very confident	Not at all confident
explain how a solar cell works	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

BLOCK B: COLOUR VISION AND DISPLAYS



Q4 Have you used the colour filters and Newton's spinning colour wheel? Yes Continue to Q5
No Skip to Block C

Q5 Please tick one box on each row to show how much you agree or disagree with the statement.

	Strongly Agree	Agree	Disagree	Strongly Disagree
I enjoyed learning with the colour filters	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I understand how light allows us to see things	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Using the colour filters made me more likely to take a science in my options	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q6 How confident are you that you could now... explain how mixing red, green and blue light can create any colour e.g. on an LCD

	Very confident	Quite confident	Not very confident	Not at all confident
...explain how mixing red, green and blue light can create any colour e.g. on an LCD	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

BLOCK C: ILLUMINATION AND COMMUNICATION



Q7 Have you used the LED and Halogen lights with hand-cranked generator? Yes Continue to Q8
No Skip to Block D

Q8 Please tick one box on each row to show how much you agree or disagree with the statement.

	Strongly Agree	Agree	Disagree	Strongly Disagree
I enjoyed learning with LEDs and optical fibres	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I understand how an optical fibre works	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Using the LEDs and optical fibres made me more likely to take a science in my options	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q9 How confident are you that you could now...
...explain how an LED uses less power

	Very confident	Quite confident	Not very confident	Not at all confident
...explain how an LED uses less power	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

BLOCK E: CONCLUSION

Q13 Please CIRCLE the THREE statements about the optoelectronics topics that are closest to how you feel about this work in science.

I could work at my own pace

I already knew a lot of the work

There was a lot of hands-on work

It made me think

I could work in a group

I could ask lots of questions

It helped me understand science

The ideas were modern

I want to do more work like this

It was a bit too hard for me

It had real life applications

Q14 Are you... Male Female

Q15 Please tick which year group you are in. S1 S2 S3

THANK YOU FOR COMPLETING THIS FORM - PLEASE HAND IT BACK TO YOUR TEACHER, WHO WILL SEND IT BACK TO THE NATIONAL EVALUATION TEAM.

Optoelectronics Equipment and Materials Feedback

Dear Student,

This short questionnaire is to ask you about science equipment designed to try to make your studies more interesting and to help your understanding in four areas of science (optoelectronics). We would be very grateful for your views on these pieces of equipment/materials. Your feedback will be used to see if more materials should be designed and put into more schools. Please answer the questions about any three of the four topic areas you remember studying. Your answers are anonymous, so there's no need to write your name on this sheet.

BLOCK A: SOLAR CELLS IN ACTION



Q1 Have you used the solar cell buggy and lamps? Yes Continue to Q2
No Skip to Block B

Q2 Please tick one box on each row to show how much you agree or disagree with the statement.

	Strongly Agree	Agree	Disagree	Strongly Disagree
I enjoyed working with the solar cell buggy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I understand why some people have solar panels on their roof	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Using the solar cell buggy made me more likely to take a science in my options	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q3 How confident are you that you could now... explain how a solar cell works

	Very confident	Quite confident	Not very confident	Not at all confident
explain how a solar cell works	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

BLOCK B: COLOUR VISION AND DISPLAYS



Q4 Have you used the colour filters and Newton's spinning colour wheel? Yes Continue to Q5
No Skip to Block C

Q5 Please tick one box on each row to show how much you agree or disagree with the statement.

	Strongly Agree	Agree	Disagree	Strongly Disagree
I enjoyed learning with the colour filters	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I understand how light allows us to see things	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Using the colour filters made me more likely to take a science in my options	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q6 How confident are you that you could now... explain how mixing red, green and blue light can create any colour e.g. on an LCD

	Very confident	Quite confident	Not very confident	Not at all confident
...explain how mixing red, green and blue light can create any colour e.g. on an LCD	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

BLOCK C: ILLUMINATION AND COMMUNICATION



Q7 Have you used the LED and Halogen lights with hand-cranked generator? Yes Continue to Q8
No Skip to Block D

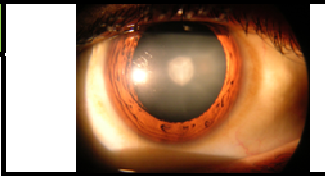
Q8 Please tick one box on each row to show how much you agree or disagree with the statement.

	Strongly Agree	Agree	Disagree	Strongly Disagree
I enjoyed learning with LEDs and optical fibres	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I understand how an optical fibre works	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Using the LEDs and optical fibres made me more likely to take a science in my options	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q9 How confident are you that you could now...
...explain how an LED uses less power

	Very confident	Quite confident	Not very confident	Not at all confident
...explain how an LED uses less power	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

BLOCK D: HUMAN VISION



Q10 Have you used the vision kit to explore LCDs and how lenses can correct sight? Yes Continue to Q11
No Skip to Block E

Q11 Please tick one box on each row to show how much you agree or disagree with the statement.

	Strongly Agree	Agree	Disagree	Strongly Disagree
I enjoyed learning about how we see and how we can correct our vision	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I understand how visual defects can affect people's lives	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Using the visual learning materials made me more likely to take a science in my options	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q12 How confident are you that you could now...
...explain how mixing red, green and blue light can create any colour e.g. on an LCD

	Very confident	Quite confident	Not very confident	Not at all confident
...explain how mixing red, green and blue light can create any colour e.g. on an LCD	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

BLOCK E: CONCLUSION

Q13 Please CIRCLE the THREE statements about the optoelectronics topics that are closest to how you feel about this work in science.

I could work at my own pace	I already knew a lot of the work	There was a lot of hands-on work	It made me think
I could work in a group	I could ask lots of questions	It helped me understand science	
The ideas were modern	I want to do more work like this	It was a bit too hard for me	It had real life applications

Q14 Are you... Male Female

Q15 Please tick which year group you are in. Y7 Y8 Y9

THANK YOU FOR COMPLETING THIS FORM - PLEASE HAND IT BACK TO YOUR TEACHER, WHO WILL SEND IT BACK TO THE NATIONAL EVALUATION TEAM.