



SMART Spaces: Chemistry Teaching

Pilot Report: Appendices

July 2023

Jeremy Hodgen, Mark Hardman, Nicola Bretscher, Haira Gandolfi, Helen Lawson and Jake Anders.



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The logo for the What Works Network. It consists of the words "What Works Network" in a teal sans-serif font, followed by a large, stylized graphic of the letter 'W' made of three overlapping teal shapes.

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About the evaluator

The project was independently evaluated by a team from UCL Institute of Education:

Professor Jeremy Hodgen: PI, overall direction and evaluation lead.

Dr Mark Hardman: pilot evaluation lead

Dr Nicola Bretscher: statistical analysis

Dr Jake Anders: statistical advice

Dr Haira Gandolfi: fieldwork

Dr Helen Lawson: fieldwork and analysis

Katie Pepper: day-to-day support to the project, including data collection and information governance

Contact details

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Jeremy.Hodgen@ucl.ac.uk

Appendices:

Appendix 1a – Memorandum of Understanding Signed by Schools

SMART Spaces Teaching Version Pilot Study

MEMORANDUM OF UNDERSTANDING

Aims of the project

The aim of this project is to study the design and implementation of *SMART Spaces* teaching programme.

The project

The project will work with 15 schools to see if this new version of the already established SMART Spaces revision programme¹ can be used in a more integrated way during teaching of AQA GCSE Chemistry across the 2018/19 school year. Five schools experienced in the delivery of SMART Spaces lessons will act as a community of practice (COP) to help us further develop the programme, while 10 further schools will implement the programme helping us to explore the feasibility, promise and scalability of the programme.

Who is involved?

Queen's University Belfast (QUB) and Hallam Teaching School Alliance (the "project team") are working together on the SMART Spaces project funded by Education Endowment Foundation (EEF) and the Wellcome Foundation, which aims to improve teaching skills in chemistry and raise GCSE science grades. The project is being researched by a team from UCL Institute of Education (the "research team").

This memorandum of understanding (MoU) explains what your school's participation in the study will entail. If you agree to take part and accept the terms and conditions outlined, please sign a copy of this form, and return by email to maria.cockerill@qub.ac.uk.

Structure of the study

As this is a design and implementation study, all schools will participate in programme delivery and feedback between (Jul 2018 – July 2019):

1. 5 schools ('Experienced' group) – These schools, **who have previously experienced the programme**, will deliver the SMART Spaces teaching programme to Year 10 in 2018/19. They will also act as a community of practice (COP) working with the programme delivery team to refine its content and delivery and feedback to the research team on the feasibility, promise and scalability of the programme.
2. 10 schools ('New' group) – These schools, who are new to SMART Spaces, will also deliver the SMART Spaces teaching programme in Year 10 in 2018/2019. They will also feedback to the research team on the feasibility, promise and scalability of the programme. Some schools in this group will be invited to take part as case study schools by the research team in October 2018.

All schools in this study will receive **£1000** following the completion of all research requirements with staff/school and with the required pupils in 2018 and 2019. After the research has finished, the school may purchase the *SMART Spaces* programme from QUB/HTSA for use from January 2020.

¹ <https://educationendowmentfoundation.org.uk/projects-and-evaluation/projects/smart-spaces/>

Use of Data

All data will be treated with the strictest confidence and will be stored in accordance with the data protection legislation, including the General Data Protection Regulation (GDPR) which came into effect in May 2018. Personal data will be processed as per condition 6(1)e of the GDPR under public task purposes UCL and QUB have reviewed current ICO guidance available here: <https://ico.org.uk/for-organisations/guide-to-the-general-data-protection-regulation-gdpr/lawful-basis-for-processing/public-task/>, and has determined that this research forms part of its performance of a task in the public interest, as one of its core purposes provided for in their Charter and Statutes. The GDPR therefore does not require the collection of (opt-in) consent for this project. To ensure that pupils and parents/carers are comfortable for their, or their children's, data to be processed in this way, we will also providing an opportunity for pupils and/or parents/carers to object and withdraw their children from the project and any data processing.

This involves us sharing data between the delivery team partners (QUB/HTSA) research team (UCL/IOE) with the Education Endowment Foundation (EEF, who funded the study), EEF's data contractors Fischer Family Trust Education, Durham University and storing the data in an anonymised form in the UK Data Archive. All results will be anonymised so that no schools or individual pupils or teachers will be identified in any report arising from the research.

Requirements for All Schools

- Schools must have some of their pupils enrolled in AQA GCSE double award science.
- Before being officially signed up to the project in July 2018, all schools are required to confirm GCSE Science examination board and specification and return student information for all Year 10 pupils who are enrolled in double award science in your school (student first and surnames, date of birth, gender, eligibility for FSM).
- All schools will provide the SMART Spaces programme team with contact details for their data manager to facilitate the return of the requested data to the research team.
- All schools will print and deliver letters to parents/carers giving them information about the study and an opportunity to withdraw their child from the data gathering process, and will inform the Evaluation Team of any responses arising.
- All schools will follow QUB and UCL Institute of Education guidance on the secure transfer of data.
- Allow all teachers delivering SMART Spaces to be available for a half day of training in September 2018 from the SMART Spaces team prior to programme delivery
- Allow all teachers delivering SMART Spaces to be available for one follow up support session carried out by the SMART Spaces team during October 2018-December 2019.
- Deliver the SMART Spaces teaching programme to all Y10 AQA double award GCSE science classes in three lessons over a one week period three times over to their year 10 class, totalling nine lessons altogether across the 2018/19 school year.
- Facilitate a short on-line questionnaire for all year 10 AQA GCSE double award students twice during the 2018/19 school year.
- All teachers and Head of Science complete three on-line questionnaires over the 2018/19 school year. They may be contacted again in June 2020 for a second questionnaire.
- **If the school has to withdraw from the project for operational or other unavoidable reasons, it will notify the research and project teams straight away and wherever possible still provide data for the research.**

Requirements for 'Experienced' schools

- Allow all teachers delivering SMART Spaces to attend a half day community of practice workshop on SMART Spaces teaching version programme design. The project team will collect data (e.g. audio recordings) from these workshops to inform research and development of the SMART spaces programme.
- Allow teachers to attend 3 further community of practice workshops during the 2018/19 school year.

Requirements for 'New' Schools

- Some schools will be invited to take part as case study schools by the research team in October 2018. Case study schools will allow the research team access to collect data (for example through lesson observations and interviews).

Responsibilities of HTSA and QUB Project Team:

- To facilitate the community of practice workshops and to collect and analyse data from the workshops to inform further development of the SMART Spaces programme.
- To provide teachers in all schools with a half-day of training in September/October 2018 from the SMART Spaces team prior to programme delivery.
- Provide all teachers with one follow up support session carried out by the SMART Spaces team during October 2018-December 2018.
- Collect participating staff and lead contact names and email details and share with the research team. Contact details will only be shared with the Research Team after ethical approval has been granted by the UCL ethics committee.
- To work closely with the Research Team

Responsibilities of the Research Team from IOE:

- Act as the first point of contact for any questions about the research
- Provide electronic copies of information sheets and consent forms for parents/carers (via the project team)
- Provide guidance to schools on how to collect and return data safely and securely
- Collect class and pupil level data including student names, date of birth, gender, eligibility for FSM.
- Organise the distribution (to schools) and subsequent collection of a questionnaire for Year 10 AQA GCSE double award students twice during the 2018/19 school year.
- Conduct surveys with teaching staff and Heads of Science
- Contact New Schools asking them to be involved as a case study school in October 2018
- Collect data from case study schools, for example through lesson observations and interviews.
- Analyse the data from the project
- Disseminate the research findings in collaboration with the Project Team
- To work closely with the Project Team

Head teacher agreement

I agree for my school to take part in the SMART Spaces study and I accept the eligibility terms and conditions.

School Name:

Head Teacher Name:

Head Teacher Signature: _____ Date:

____/____/____

Head Teacher Email Address:

School Contact (if not Head Teacher):

School Contact Email Address (if not Head Teacher):

School Telephone Number:

Data Manager Name:

Data Manager Email Address:

Thank you for agreeing to take part in this research.

Please complete the information below and return this form to:

xxxxxxxxxxxxx@qub.ac.uk

Please answer the following questions about your school.

LA area and County	
School LA Establishment/DFE Number (a seven digit number)	
School admin email	
School Ofsted rating	
% FSM Ever	
% EAL pupils	

This MoU constitutes the school's agreement with Queen's University Belfast, Hallam Teaching Alliance and UCL Institute of Education to participate in the SMART Spaces study.

Appendix 1b – Information Sheets and Withdrawal Form for Teachers in Pilot

SMART Spaces Teaching Programme

What is this about?

As you will know, Queen's University Belfast and Hallam Teaching School Alliance (the "project team") are working together on SMART Spaces Teaching Programme, a project funded by Education Endowment Foundation (EEF) and the Wellcome Foundation, which aims to improve teaching skills in chemistry and raise GCSE science grades. The effectiveness of the project will be evaluated by a team from UCL Institute of Education (the "evaluation team"). This research has been reviewed and approved by the research ethics committee of UCL Institute of Education. The headteacher of your school has agreed that the school will take part in the research programme.

What will the project look like?

The project investigates the implementation of a teaching programme in the chemistry element of the GCSE double award science, run by the project team. The project team will work with teachers and schools to teach a programme that we think will benefit your students' learning in science. The project will involve all the year 10 double award science classes from 15 schools during 2018-19.

What does this mean for me?

As part of investigating the implementation of this teaching programme, you will be asked to complete an online survey at the beginning and at the end of the programme. This will take less than 15 minutes. Your name will be collected by the project and evaluation teams to allow tracking of survey data. We are collecting this information for the purposes of the research project, to help us understand how the SMART Spaces teaching programme helps children to learn chemistry for their GCSE science exam. In addition, we will observe lessons and interview teachers in some schools to find out how well SMART Spaces is implemented. If your school is chosen to take part in this additional research, we will contact you again to ask for your consent to take part in this element of the research. No information that can identify individuals will be made available to anyone outside these teams and your school. Your data will be treated with the strictest confidence and will be kept securely under password protection, for up to 10 years in line with UCL regulations. We will not use your name or the name of the school in any report arising from the research, and no information that could otherwise identify you will be made public. All use of data will be compliant with the GDPR and data protection legislation.

If you have any questions you would like to ask about the project, please contact the research team or Jeremy Hodgen at the UCL Institute of Education by email at ioe.smartspaces@ucl.ac.uk

Because we are doing this research to improve understanding about what works in improving pupils' education, **if you are happy for information about you to be used in the SMART Spaces research project you do not need to do anything.** Thank you for your help with this research, your support is much appreciated.

If you **DO NOT** want information about you to be used to understand whether the SMART Spaces programme can help improve teaching in chemistry and raise GCSE science grades, please complete the enclosed form and return it to the evaluation team by the end of January 2019. If you do this, then no information about you will be shared with the evaluation or project teams at any point during the project and you won't be disadvantaged in any way. In addition, you can ask for your data to be withdrawn from the project at any time until 31st August 2019, without giving a reason, by contacting us via email at **ioe.smartspaces@ucl.ac.uk**

SMART Spaces research programme: withdrawal form

(If you are happy to participate in the research on whether this programme improves teaching and learning in science, you DO NOT need to return this form.)

I **DO NOT** wish my data to be collected as part of this research.

Your name: Date of birth:

School:.....

Your signature:

Date

(Please return the completed form to the evaluation team.)

Appendix 1c – Information Sheets and Consent Forms for Teachers in Case Study Schools

SMART Spaces Teaching Programme

What is this about?

As you will know, your school is taking part in an exciting project called “*SMART Spaces Teaching Programme*”. Queen’s University Belfast and Hallam Teaching School Alliance (the “project team”) are working together on SMART Spaces, a project funded by Education Endowment Foundation and the Wellcome Foundation, which aims to improve teaching skills in chemistry and raise GCSE science grades. The effectiveness of the project will be evaluated by a team from UCL Institute of Education (the “evaluation team”). This research has been reviewed and approved by the research ethics committee of UCL Institute of Education. The headteacher of your school has agreed that the school will take part in the research programme.

What’s happening now?

As part of this work, we are planning to observe all or part of six lessons in your science class across the school year. We may also interview you about the sessions and your approaches to teaching in science. The interview will be no longer than 30 minutes. We want to do this in order to make sure we understand what has actually happened in schools as part of the project.

Who will be undertaking this research?

As with the rest of the project, these observations and interviews will be carried out by experienced researchers from UCL Institute of Education. All the researchers have full Disclosure and Barring Service (DBS) checks to reassure you that they are safe to work in schools.

What does this mean for me?

We want to make sure you have no problem with us observing and interviewing you as part of this project. As such, we will only involve you in the research **if you have let us know that you are happy for us to do so**. There is a form attached to this letter and we would be very grateful if you could return this to us as soon as possible.

What if I do not want to take part?

Your participation in this research is voluntary. If you choose not to take part, that’s fine and you will not be disadvantaged in any way. In addition, you can request for your data to be withdrawn from the research at any time until 30th November 2019 without giving a reason. Just get in touch, using the email address below and we will withdraw your data from the project.

How is confidentiality maintained?

All data provided will be treated as highly confidential. We will not keep any information about you from these discussions other than your name (this is so that we can respect any wish to withdraw after the discussion has happened) and notes or audio-recordings we make of interviews and observations. The only exception to this is if you tell us something that raises concerns regarding child safeguarding when, as you would expect, we are obliged to inform the school's safeguarding officer and liaise with them on appropriate action. All the data will be stored on secure, password protected computers to which only members of the research team have access, for up to 10 years in line with UCL regulations. When we are writing up the research we will double check it is not possible to identify either individuals or schools from what we report. All use of data will be compliant with the GDPR and data protection legislation.

What if I have any questions?

If you have any concerns and would like to know more, or if you have any questions, please contact Jeremy Hodgen at the UCL Institute of Education by email at [**ioe.smartspaces@ucl.ac.uk**](mailto:ioe.smartspaces@ucl.ac.uk)

SMART Spaces Teaching Programme

OBSERVATION AND INTERVIEW CONSENT FORM

An information sheet is attached to this form. Please read it carefully before making a decision about taking part in this research.

We will only involve you in the observation and interview if you have returned this form by [DATE].

SMART Spaces Teaching Programme evaluation

- | | |
|---|--------------------------|
| 1. I confirm that I have read the attached information sheet and have had the opportunity to consider the information, to ask questions, and (if applicable) that I have had these answered satisfactorily. | ☐ |
| 2. I understand that my participation in this research is voluntary and I can request for my data to be withdrawn from the research at any time until 30 th November 2019 without giving a reason. | ☐ |
| 3. I understand that the classroom observation may be audio recorded. | ☐ |
| 4. I understand that the interview will be audio recorded. | ☐ |
| 5. I agree to the use of my anonymised quotes. | ☐ |
| 6. I agree that any data collected may be passed to other researchers in the team (at UCL Institute of Education and Queen's University Belfast). | ☐ |
| 7. I agree that any data collected may be published in anonymous form in reports, books, conference papers or journal articles. | ☐ |

Name:

School:.....

Signature:

Date

(Please return the completed form to the UCL Institute of Education Evaluation team)

Appendix 1d – Information Sheet and Withdrawal Forms for Parents

SMART Spaces Teaching Programme

What is this about?

Queen's University Belfast and Hallam Teaching School Alliance (the "project team") are working together on SMART Spaces, a project funded by Education Endowment Foundation (EEF) and the Wellcome Foundation, which aims to improve teaching skills in chemistry and raise GCSE science grades. The effectiveness of the project will be evaluated by a team from UCL Institute of Education (the "evaluation team"). This research has been reviewed and approved by the research ethics committee of UCL Institute of Education. The headteacher of your child's school has agreed that the school will take part in the research programme.

What will the project look like?

The project investigates a teaching programme in the chemistry element of the GCSE double award science, run by the project team. The project team will work with teachers and schools to teach a programme that we think will benefit your child's learning in science. The project will involve all the year 10 double award science classes from 15 schools during 2018-19.

What does this mean for me as a parent?

As part of investigating this teaching programme, your child will be asked to complete an online survey at the beginning and at the end of the programme. This will take about 15 minutes. Your child's name will be collected by the project and evaluation teams to allow tracking of survey data. We are collecting this information for the purposes of the research project, to help us understand how the SMART Spaces teaching programme helps children like yours to learn chemistry for their GCSE science exam. In addition, we will observe lessons and interview pupils in some schools to find out how well SMART Spaces is implemented. If your child's school is chosen to take part in this additional research, we will contact you again to ask for your consent for your child to take part in this element of the research. No information that can identify individual children will be made available to anyone outside these teams and your child's school. Your child's data will be treated with the strictest confidence and will be kept securely under password protection, for up to 10 years in line with UCL regulations. We will not use your child's name or the name of the school in any report arising from the research, and no information that could otherwise identify your child will be made public. All use of data will be compliant with the GDPR and data protection legislation.

If you have any questions you would like to ask about the project, please contact the research team, led by Prof. Jeremy Hodgen at the UCL Institute of Education, by email at ioe.smartspaces@ucl.ac.uk

Because we are doing this research to improve understanding about what works in improving pupils' education, **if you are happy for information about your child to be used in the SMART Spaces research project you do not need to do anything.** Thank you for your help with this research, your support is much appreciated.

If you **DO NOT** want information about your child to be used to understand whether the SMART Spaces programme can help improve teaching skills in chemistry and raise GCSE science grades, please complete the enclosed form and return it to your child's school by [INSERT DATE]. If you do this, then no information about your child will be shared with the evaluation or project teams at any point during the project and your child won't be disadvantaged in any way. In addition, you can ask for your child's data to be withdrawn from the project at any time until 31st August 2019, without giving a reason, by contacting us via email at **ioe.smartspaces@ucl.ac.uk**

SMART Spaces research programme: withdrawal form

(If you are happy for your child to participate in the research on whether this programme improves teaching and learning in science, you DO NOT need to return this form.)

I DO NOT wish my data about my child to be collected as part of this research.

Child's name: Date of birth:

Child's Chemistry/Science Teacher:

School:.....

Parent name (BLOCK CAPITALS)

Parent signature:

Date

(Please return the completed form to your child's chemistry/science teacher.)

Appendix 1e – Information Sheet and Consent Forms for Parents of Pupils in Pilot Schools

SMART Spaces Teaching Programme

What is this about?

Unless your child is new to the school, we've previously let you know about an exciting project that they are part of called "*SMART Spaces Teaching Programme*". Queen's University Belfast and Hallam Teaching School Alliance (the "project team") are working together on SMART Spaces, a project funded by Education Endowment Foundation (EEF) and the Wellcome Foundation, which aims to improve teaching skills in chemistry and raise GCSE science grades. The effectiveness of the project will be evaluated by a team from UCL Institute of Education (the "evaluation team"). This research has been reviewed and approved by the research ethics committee of UCL Institute of Education. The headteacher of your child's school has agreed that the school will take part in the research programme.

What's happening now?

As part of this work, we are planning to observe all or part of six lessons in your child's science class across the school year. We may also interview a number of students in small groups about the sessions and how they learn in science. The interview will be no longer than 20 minutes. We want to do this in order to make sure we understand what has actually happened in schools as part of the project.

Who will be undertaking this research?

As with the rest of the project, these observations and interviews will be carried out by experienced researchers from UCL Institute of Education. All the researchers have full Disclosure and Barring Service (DBS) checks to reassure you that they are safe to work in schools.

What does this mean for me as a parent?

We want to make sure you have no problem with us observing and interviewing your child as part of this project. It is very important to us not to do anything you are not happy with. As such, we will only speak to your child about the research **if you have let us know that you are happy for us to do so**. There is a form attached to this letter and we would be very grateful if you could return this to your child's science teacher as soon as possible.

What if my child does not want to take part?

We would never make your child do something they do not want to do. If your child does not wish to participate in the observations and discussions on the day, that's fine and your child won't be disadvantaged in any way. In addition, if you or they decide afterwards that you are not happy for us to use your child's responses, just get in touch and we will withdraw their data from the project. You

can ask for your data to be withdrawn from the project at any time until 30th November 2019, without giving a reason, by contacting us via email at **ioe.smartspaces@ucl.ac.uk**

How is confidentiality maintained?

All data provided will be treated as highly confidential. We will not keep any information about your child from these discussions other than their name (this is so that we can respect any wish to withdraw after the discussion has happened) and notes or audio-recordings we make of interviews and observations. The only exception to this is if your child tells us something that raises concerns regarding child safeguarding when, as you would expect, we are obliged to inform the school's safeguarding officer and liaise with them on appropriate action. All the data will be stored on secure, password protected computers to which only members of the research team have access, for up to 10 years in line with UCL regulations. When we are writing up the research we will double check it is not possible to identify either children or schools from what we report. All use of data will be compliant with the GDPR and data protection legislation.

What if I have any questions?

If you have any concerns and would like to know more, or if you have any questions, please contact Jeremy Hodgen at the UCL Institute of Education by email at **ioe.smartspaces@ucl.ac.uk**

SMART Spaces Teaching Programme

OBSERVATION AND INTERVIEW CONSENT FORM

An information sheet is attached to this form. Please read it carefully before making a decision about letting your child take part in this research.

We will only involve children in the observation and interview if your child's school holds a completed and signed consent form.

SMART Spaces Teaching Programme evaluation

I confirm that I have read the attached information sheet and have had the opportunity to consider the information, to ask questions, and (if applicable) that I have had these answered satisfactorily.

☐

I understand that my child's participation in this research is voluntary and they or I can request to be withdrawn from the research at any time until 30th November 2019 without giving a reason.

☐

I understand that the classroom observation may be audio recorded.

☐

I understand that the interview will be audio recorded.

☐

I agree to the anonymous use of quoted speech from my child.

☐

I agree that any data collected may be passed to other researchers in the team (at UCL Institute of Education and Queen's University Belfast).

☐

I agree that any data collected may be published in anonymous form in reports, books, conference papers or journal articles.

☐

I AM HAPPY for my child to be part of a discussion about the project as part of this research.



Child's name: Date of birth:

Child's class Teacher:

School:.....

Parent / Carer name (BLOCK CAPITALS)

Parent / Carer signature: Date

(Please return the completed form to your child's science teacher.)

Appendix 1f – Information Sheets and Consent Forms for Pupils in Pilot

SMART Spaces Teaching Programme

What is this about?

Queen's University Belfast and Hallam Teaching School Alliance (the "project team") are working together on SMART Spaces, a project which aims to improve teaching and learning in chemistry and raise GCSE science grades. The project will be evaluated by a team from UCL Institute of Education (the "evaluation team"). This research has been reviewed and approved by the research ethics committee of UCL Institute of Education. The headteacher of your school has agreed that the school will take part in the research programme.

What will the project look like?

The project investigates a teaching programme in the chemistry element of the GCSE double award science, run by the project team. The project team will work with teachers and schools to teach a programme that we think will benefit your learning in science. The project will involve all the year 10 double award science classes from 15 schools during 2018-19.

What does this mean for me?

As part of investigating this teaching programme, you will be asked to complete an online survey at the beginning and at the end of the programme. This will take about 15 minutes. Your name will be collected by the project and evaluation teams to allow matching of the survey data at the start and end of the programme. We are collecting this information for the purposes of the research project, to help us understand how the SMART Spaces teaching programme helps students like you to learn chemistry for your GCSE science exam. In addition, we will observe lessons and interview pupils in some schools to find out how well SMART Spaces is implemented. If your school is chosen to take part in this additional research, we will contact you again to ask for your permission to take part in this element of the research. No information that can identify individual students will be made available to anyone outside these teams and your school. Your data will be treated with the strictest confidence and will be kept securely under password protection, for up to 10 years in line with UCL regulations. We will not use your name or the name of the school in any report arising from the research, and no information that could otherwise identify you will be made public. All use of data will be compliant with the GDPR and data protection legislation.

If you have any questions you would like to ask about the project, please contact the research team, led by Prof. Jeremy Hodgen at the UCL Institute of Education, by email at ioe.smartspaces@ucl.ac.uk

Because we are doing this research to improve understanding about what works in improving education, **if you are happy for information about you to be used in the SMART Spaces research project you do not need to do anything.** Thank you for your help with this research, your support is much appreciated.

If you **DO NOT** want information about you to be used to understand whether the SMART Spaces programme can help improve teaching skills in chemistry and raise GCSE science grades, please complete the enclosed form and return it to your school by [INSERT DATE]. If you do this, then no information about you will be shared with the evaluation or project teams at any point during the project and you won't be disadvantaged in any way. In addition, you can ask for your data to be withdrawn from the project at any time until 31st August 2019, without giving a reason, by contacting us via email at **ioe.smartspaces@ucl.ac.uk**

SMART Spaces research programme: withdrawal form

(If you are happy to participate in the research on whether this programme improves teaching and learning in science, you DO NOT need to return this form.)

I DO NOT wish my data to be collected as part of this research.

Your name: Date of birth:

Your Chemistry/Science Teacher:

School:.....

Your signature:

Date

(Please return the completed form to your chemistry/science teacher.)

Appendix 1g – Information Sheet and Consent Forms for Pupils in Case Study Schools

SMART Spaces Teaching Programme

What is this about?

Unless you are new to the school, we've previously let you know about an exciting project that your school is part of called "*SMART Spaces Teaching Programme*". Queen's University Belfast and Hallam Teaching School Alliance (the "project team") are working together on SMART Spaces, a project funded by Education Endowment Foundation (EEF) and the Wellcome Foundation, which aims to improve teaching skills in chemistry and raise GCSE science grades. The effectiveness of the project will be evaluated by a team from UCL Institute of Education (the "evaluation team"). This research has been reviewed and approved by the research ethics committee of UCL Institute of Education. The headteacher of your school has agreed that the school will take part in the research programme.

What's happening now?

As part of this work, we are planning to observe all or part of six lessons in your science class across the school year. We may also interview a number of students in small groups about the sessions and how they learn in science. The interview will be no longer than 20 minutes. We want to do this in order to make sure we understand what has actually happened in schools as part of the project.

Who will be undertaking this research?

As with the rest of the project, these observations and interviews will be carried out by experienced researchers from UCL Institute of Education. All the researchers have full Disclosure and Barring Service (DBS) checks to reassure you that they are safe to work in schools.

What does this mean for me?

We want to make sure you have no problem with us observing and interviewing you as part of this project. It is very important to us not to do anything you are not happy with. As such, we will only speak to you about the research **if you have let us know that you are happy for us to do so**. There is a form attached to this letter and we would be very grateful if you could return this to your science teacher as soon as possible.

What if you do not want to take part?

We would never make you do something you do not want to do. If you do not wish to participate in the observations and discussions on the day, that's fine and you won't be disadvantaged in any way. In addition, if you decide afterwards that you are not happy for us to use your responses just get in touch, or ask your science teacher or your parent/carer to contact us, using the email address below and we will withdraw your data from the project. You can ask for your data to be withdrawn from the

project at any time until 30th November 2019, without giving a reason, by contacting us via email at **ioe.smartspaces@ucl.ac.uk**

How is confidentiality maintained?

All data provided will be treated as highly confidential. We will not keep any information about you from these discussions other than your name (this is so that we can respect any wish to withdraw after the discussion has happened) and notes or audio-recordings we make of interviews and observations. The only exception to this is if you tell us something that raises concerns regarding child safeguarding when, as you would expect, we are obliged to inform the school's safeguarding officer and liaise with them on appropriate action. All the data will be stored on secure, password protected computers to which only members of the research team have access, for up to 10 years in line with UCL regulations. When we are writing up the research we will double check it is not possible to identify either children or schools from what we report. All use of data will be compliant with the GDPR and data protection legislation.

What if I have any questions?

If you have any concerns and would like to know more, or if you have any questions, please contact Jeremy Hodgen at the UCL Institute of Education by email at **ioe.smartspaces@ucl.ac.uk**

SMART Spaces Teaching Programme

OBSERVATION AND INTERVIEW CONSENT FORM

An information sheet is attached to this form. Please read it carefully before making a decision about taking part in this research.

We will only involve you in the observation and interview if your school holds a completed and signed consent form by [DATE].

SMART Spaces Teaching Programme evaluation

I confirm that I have read the attached information sheet and have had the opportunity to consider the information, to ask questions, and (if applicable) that I have had these answered satisfactorily.

☐

I understand that my participation in this research is voluntary and I can request to be withdrawn from the research at any time until 30th November 2019 without giving a reason.

☐

I understand that the classroom observation may be audio recorded.

☐

I understand that the interview will be audio recorded.

☐

I agree to the anonymous use of my quoted speech.

☐

I agree that any data collected may be passed to other researchers in the team (at UCL Institute of Education and Queen's University Belfast).

☐

I agree that any data collected may be published in anonymous form in reports, books, conference papers or journal articles.

☐

I AM HAPPY to be part of a discussion about the project as part of this research.



Your name: Date of birth:

Your class Teacher:

School:.....

(Please return the completed form to your science teacher.)

Smart Spaces Teaching Pilot, Teacher Survey

This survey should take around 15 minutes to complete and will help us understand the benefits and drawbacks of delivering the SMART Spaces chemistry teaching programme within your school. The responses provided will be treated with the strictest confidence and will be kept securely on an encrypted system. We will not use your name or the name of your school in any report and no information that could otherwise identify you will be made public.

Even after submitting the survey, you have the right to withdraw your data any time up until 30th November 2019. If you wish to do so or have any questions, please contact the evaluation team at the UCL Institute of Education by e-mail at ioe.smartspaces@ucl.ac.uk

We are very grateful for your help with this research, which we hope will be of benefit to others.

1) First Name

2) Surname

3) School Name

4) Today's Date (click Today button)

How often in your chemistry lessons, and the chemistry homework you set, do students do the following? (select one option per row)

	Almost never	Occasionally	Fairly often	Most of the time	Almost always
5) Learn about ideas and theories in chemistry.	☐	☐	☐	☐	☐
6) Revisit or revise ideas and theories.	☐	☐	☐	☐	☐
7) Learn about experiments and processes.	☐	☐	☐	☐	☐
8) Use equations or do calculations.	☐	☐	☐	☐	☐
9) Develop a prediction, hypothesis or explanation.	☐	☐	☐	☐	☐
10) Plan or do scientific investigations or experiments.	☐	☐	☐	☐	☐
11) Work with data or graphs.	☐	☐	☐	☐	☐
12) Identify patterns and draw conclusions.	☐	☐	☐	☐	☐
13) Evaluate investigations to suggest improvements.	☐	☐	☐	☐	☐
14) Discuss how ideas, theories and models in chemistry are developed and change over time.	☐	☐	☐	☐	☐
15) Consider the role of chemistry in real world situations and technologies.	☐	☐	☐	☐	☐
16) Consider jobs that involve chemistry, or what scientists do.	☐	☐	☐	☐	☐
17) Discuss problems in the world, and the role that chemistry might play.	☐	☐	☐	☐	☐

Smart Spaces Teaching Pilot, Teacher Survey

Are you a Head of Department and/or had responsibility for coordinating the SMART Spaces lessons within chemistry teaching?

☐ Yes
☐ No

Are you a chemistry specialist?

☐ Yes
☐ No

For how many years have you been teaching chemistry or science? (please use a numerical value)

We would be grateful if you could answer these questions as the person with oversight of the SMART Spaces intervention in your department.

How many classes in total in your school are undertaking AQA double award chemistry/science? (please enter a number)

How many classes in your school are involved in the SMART Spaces pilot? (please enter a number)

Of AQA double award chemistry/science classes, which were involved in the SMART Spaces intervention?

- ☐ All classes
☐ Only lower attaining classes
☐ Only higher attaining classes
☐ A mixture of classes (but not all of them)

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly Agree
It has been easy to organise teaching to fit the SMART Spaces lessons covering AQA Chemistry Paper 1 in.	☐	☐	☐	☐	☐
It has been easy to organise teaching to fit the SMART Spaces lessons covering AQA Chemistry Paper 2 in.	☐	☐	☐	☐	☐
Overall, the department benefited from including SMART Spaces within teaching.	☐	☐	☐	☐	☐
We would use SMART Spaces in the future as part of our revision with Year 10.	☐	☐	☐	☐	☐
We would use SMART Spaces in the future as part of our revision with Year 11.	☐	☐	☐	☐	☐
We would use SMART Spaces in the future prior to teaching the content of the slides.	☐	☐	☐	☐	☐
Senior leaders have been supportive of the SMART Spaces intervention.	☐	☐	☐	☐	☐
The SMART Spaces team provided everything we needed to run the pilot as a department.	☐	☐	☐	☐	☐
We would be happy to use SMART Spaces in biology and physics too.	☐	☐	☐	☐	☐

The SMART Spaces team provided helpful guidance in how we might change normal practice after delivering SMART Spaces.



How far do you agree or disagree with these statements about the promise of SMART Spaces?

	Strongly disagree	Disagree	Neither disagree or agree	Agree	Strongly Agree
SMART Spaces has the potential to speed up how quickly pupils gain knowledge and understanding in chemistry (AO1).	☐	☐	☐	☐	☐
SMART Spaces has the potential to allow me to focus more on applying knowledge and understanding (AO2) in my chemistry teaching.	☐	☐	☐	☐	☐
SMART Spaces has the potential to allow me to focus more on analysing information and ideas (AO3) in my chemistry teaching.	☐	☐	☐	☐	☐
Overall, it is worthwhile taking lessons to incorporate SMART Spaces into teaching chemistry.	☐	☐	☐	☐	☐

Please tell us about how many times you have done SMART Spaces so far:

Each block of SMART Spaces involves three lessons in a row, where you repeat the same set of slides. There is a set of slides for AQA Paper 1, and another set for AQA Paper 2. How many blocks of three SMART Spaces lessons have you done for AQA Paper 1?

- ☐ 1 block of 3 lessons
- ☐ 2 blocks of 3 lessons
- ☐ 3 blocks of 3 lessons
- ☐ 4 blocks of 3 lessons
- ☐ 5 blocks of 3 lessons
- ☐ More than 5 blocks of 3 lessons

How many blocks of three SMART Spaces lessons have you done for AQA Paper 2?

- ☐ 1 block of 3 lessons
- ☐ 2 blocks of 3 lessons
- ☐ 3 blocks of 3 lessons
- ☐ 4 blocks of 3 lessons
- ☐ 5 blocks of 3 lessons
- ☐ More than 5 blocks of 3 lessons

How far do you agree or disagree with these statements?

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly Agree
I was confident in delivering SMART Spaces	☐	☐	☐	☐	☐
My class/classes were enthusiastic to try SMART Spaces	☐	☐	☐	☐	☐
The SMART Spaces lessons helped the class learn more easily than normal lessons	☐	☐	☐	☐	☐
I think SMART Spaces works well for revision	☐	☐	☐	☐	☐
I think SMART Spaces works well for learning new things	☐	☐	☐	☐	☐
The class/classes as a whole enjoyed SMART Spaces	☐	☐	☐	☐	☐
The class/classes seemed more motivated to learn during SMART Spaces than in normal lessons	☐	☐	☐	☐	☐
I would be happy to deliver SMART Spaces again in the future	☐	☐	☐	☐	☐
I think SMART Spaces would be useful for other subjects, beyond chemistry	☐	☐	☐	☐	☐
My class/classes found the SMART Spaces lessons fun	☐	☐	☐	☐	☐
My class/classes found the SMART Spaces lessons helpful for revision	☐	☐	☐	☐	☐
My class/classes found the SMART Spaces lessons helpful for understanding things that they have not learnt about before	☐	☐	☐	☐	☐
The evidence behind SMART Spaces was important in my wanting to use it	☐	☐	☐	☐	☐
SMART Spaces is more useful for higher attaining students	☐	☐	☐	☐	☐

Please tell us which classes you delivered SMART Spaces to.

How many classes have you delivered the SMART Spaces pilot to?

- ☐ 0
☐ 1
☐ 2
☐ 3
☐ 4
☐ 5
☐ More than 5

Please name the first class that you have delivered SMART spaces to:

Please name the second class that you have delivered SMART spaces to:

Please name the third class that you have delivered SMART spaces to:

Please name the fourth class that you have delivered SMART spaces to:

Please name the fifth class that you have delivered SMART spaces to:

Please name all further classes that you have delivered SMART Spaces to. You will only be asked direct questions about the first 5 classes you have named:

These questions are about how you delivered SMART spaces to [class_1].

How far did you explain the idea behind SMART Spaces to [class_1]?

- ☐ In detail
- ☐ A little
- ☐ Not at all

Did you cover all of the slides in each lesson or skip over some with [class_1]?

- ☐ Covered all the slides.
- ☐ Skipped over some slides in some SMART Spaces lessons.
- ☐ Skipped over some slides in every SMART Spaces lesson.

Did you modify the slides in any of these ways for [class_1]?

Yes

No

Did you change the language
used?☐☐Did you change the content (text
or images)?☐☐Did you change the order of
slides presented?☐☐

There are two sets of SMART Spaces slides: one covering AQA Chemistry Paper 1, and another set covering AQA Chemistry Paper 2. Each set of slides is designed to repeat content three times on separate days, over no more than a week. For [class_1]:

	True	False
I taught the lessons in each set on separate days	☐	☐
I taught each set over no more than one week	☐	☐

How long were the lessons for [class_1]?

- ☐ Less than 60 minutes.
- ☐ 60 minutes.
- ☐ More than 60 minutes.

These questions are about the spacing activity used within SMART Spaces lessons for [class_1].

What spacing activity or activities did you do during the SMART spaces lessons with [class_1]? (tick all that apply)

- ☐ Juggling
- ☐ Plasticine modelling
- ☐ Origami
- ☐ Plate spinning
- ☐ Balloon games
- ☐ Other

Please specify the other spacing activity or activities you used with [class_1]:

Each SMART Spaces lesson consists of three blocks of chemistry content, separated by a spacing activity. How often did you deliver SMART Spaces to [class_1] using the spacing activities as intended?

- ☐ I taught all lessons with spacing activities as intended.
- ☐ I omitted a spacing activity for one or two lessons each time we used SMART Spaces.
- ☐ I omitted a spacing activity for all three lessons, each time we used SMART Spaces.

These questions are about how you delivered SMART Spaces to [class_2].

How far did you explain the idea behind SMART Spaces to [class_2]?

- ☐ In detail
- ☐ A little
- ☐ Not at all

Did you cover all of the slides in each lesson or skip over some with [class_2]?

- ☐ Covered all the slides.
- ☐ Skipped over some slides in some SMART Spaces lessons.
- ☐ Skipped over some slides in every SMART Spaces lesson.

Did you modify the slides in any of these ways for [class_2]?

Yes

No

Did you change the language
used?☐☐Did you change the content (text
or images)?☐☐Did you change the order of the
slides presented?☐☐

There are two sets of SMART Spaces slides: one covering AQA Chemistry Paper 1, and another set covering AQA Chemistry Paper 2. Each set of slides is designed to repeat content three times on separate days, over no more than a week. For [class_2]:

	True	False
I taught the lessons in each set on separate days	☐	☐
I taught each set of lessons over no more than one week	☐	☐

How long were the lessons for [class_2]?

- ☐ Less than 60 minutes.
- ☐ 60 minutes.
- ☐ More than 60 minutes.

These questions are about the spacing activity used within SMART Spaces lessons for [class_2].

What spacing activity or activities did you do during the SMART spaces lessons with [class_2]? (tick all that apply)

- ☐ Juggling
- ☐ Plasticine modelling
- ☐ Origami
- ☐ Plate spinning
- ☐ Balloon games
- ☐ Other

Please specify the other spacing activity or activities you used with [class_2]:

Each SMART Spaces lesson consists of three blocks of chemistry content, separated by a spacing activity. How often did you deliver SMART Spaces to [class_2] using the spacing activities as intended?

- ☐ I taught all lessons with spacing activities as intended.
- ☐ I omitted a spacing activity for one or two lessons each time we used SMART Spaces.
- ☐ I omitted a spacing activity for all three lessons, each time we used SMART Spaces.

Please now answer the same questions for [class_3].

How far did you explain the idea behind SMART Spaces to [class_3]?

- ☐ In detail
- ☐ A little
- ☐ Not at all

Did you cover all of the slides in each lesson or skip over some with [class_3]?

- ☐ Covered all the slides.
- ☐ Skipped over some slides in some SMART Spaces lessons.
- ☐ Skipped over some slides in every SMART Spaces lesson.

Did you modify the slides in any of these ways for [class_3]?

Yes

No

Did you modify the language
used?☐☐Did you change the content (text
or images)?☐☐Did you change the order of
slides presented?☐☐

There are two sets of SMART Spaces slides: one covering AQA Chemistry Paper 1, and another set covering AQA Chemistry Paper 2. Each set of slides is designed to repeat content three times on separate days, over no more than a week. For [class_3]:

	True	False
I taught the lessons in each set on separate days	☐	☐
I taught each set over no more than one week	☐	☐

How long were the lessons for [class_3]?

- ☐ Less than 60 minutes.
- ☐ 60 minutes.
- ☐ More than 60 minutes.

These questions are about the spacing activity used within SMART Spaces lessons for [class_3].

What spacing activity or activities did you do during the SMART spaces lessons with [class_3]? (tick all that apply)

- ☐ Juggling
- ☐ Plasticine modelling
- ☐ Origami
- ☐ Plate spinning
- ☐ Balloon games
- ☐ Other

Please specify the other spacing activity or activities you used with [class_3]:

Each SMART Spaces lesson consists of three blocks of chemistry content, separated by a spacing activity. How often did you deliver SMART Spaces to [class_3] using the spacing activities as intended?

- ☐ I taught all lessons with spacing activities as intended.
- ☐ I omitted a spacing activity for one or two lessons each time we used SMART Spaces.
- ☐ I omitted a spacing activity for all three lessons, each time we used SMART Spaces.

Please now answer these questions about how you delivered the SMART Spaces intervention with [class_4].

How far did you explain the idea behind SMART Spaces to [class_4]?

- ☐ In detail
- ☐ A little
- ☐ Not at all

Did you cover all of the slides in each lesson or skip over some?

- ☐ Covered all the slides.
- ☐ Skipped over some slides in some SMART Spaces lessons.
- ☐ Skipped over some slides in every SMART Spaces lesson.

Did you modify the slides in any of these ways for [class_4]?

Yes

No

Did you modify the language
used?☐☐Did you change the content (text
or images)?☐☐Did you change the order of
slides presented?☐☐

There are two sets of SMART Spaces slides: one covering AQA Chemistry Paper 1, and another set covering AQA Chemistry Paper 2. Each set of slides is designed to repeat content three times on separate days, over no more than a week. For [class_4]:

	True	False
I taught the lessons in each set on separate days	☐	☐
I taught each set over no more than one week	☐	☐

How long were the lessons for [class_4]?

- ☐ Less than 60 minutes.
- ☐ 60 minutes.
- ☐ More than 60 minutes.

These questions are about the spacing activity used within SMART Spaces lessons for [class_4].

What spacing activity or activities did you do during the SMART spaces lessons with [class_4]? (tick all that apply)

- ☐ Juggling
- ☐ Plasticine modelling
- ☐ Origami
- ☐ Plate spinning
- ☐ Balloon games
- ☐ Other

Please specify the other spacing activity or activities you used with [class_4]:

Each SMART Spaces lesson consists of three blocks of chemistry content, separated by a spacing activity. How often did you deliver SMART Spaces to [class_4] using the spacing activities as intended?

- ☐ I taught all lessons with spacing activities as intended.
- ☐ I omitted a spacing activity for one or two lessons each time we used SMART Spaces.
- ☐ I omitted a spacing activity for all three lessons, each time we used SMART Spaces.

Please now answer the same questions for [class_5].

How far did you explain the idea behind SMART Spaces to [class_5]?

- ☐ In detail
- ☐ A little
- ☐ Not at all

Did you cover all of the slides in each lesson or skip over some?

- ☐ Covered all the slides.
- ☐ Skipped over some slides in some SMART Spaces lessons.
- ☐ Skipped over some slides in every SMART Spaces lesson.

Did you modify the slides in any of these ways for [class_5]?

Yes

No

Did you modify the language
used?☐☐Did you change the content (text
or images)?☐☐Did you change the order of
slides presented?☐☐

There are two sets of SMART Spaces slides: one covering AQA Chemistry Paper 1, and another set covering AQA Chemistry Paper 2. Each set of slides is designed to repeat content three times on separate days, over no more than a week. For [class_5]:

	True	False
I taught the lessons in each set on separate days	☐	☐
I taught each set lessons over no more than one week	☐	☐

How long were the lessons for [class_5]?

- ☐ Less than 60 minutes.
- ☐ 60 minutes.
- ☐ More than 60 minutes.

These questions are about the spacing activity used within SMART Spaces lessons for [class_5].

What spacing activity or activities did you do during the SMART spaces lessons with [class_5]? (tick all that apply)

- ☐ Juggling
- ☐ Plasticine modelling
- ☐ Origami
- ☐ Plate spinning
- ☐ Balloon games
- ☐ Other

Please specify the other spacing activity or activities you used with [class_5]:

Each SMART Spaces lesson consists of three blocks of chemistry content, separated by a spacing activity. How often did you deliver SMART Spaces to [class_5] using the spacing activities as intended?

- ☐ I taught all lessons with spacing activities as intended.
- ☐ I omitted a spacing activity for one or two lessons each time we used SMART Spaces.
- ☐ I omitted a spacing activity for all three lessons, each time we used SMART Spaces.

These questions are about the training and support for the SMART Spaces pilot.

Did you attend a training session for SMART Spaces (at your school or a nearby school)?

☐ Yes
☐ No

Did you receive a support visit in which a member of the SMART Spaces team provided feedback on part of a lesson?

☐ Yes
☐ No

Did you receive a handbook explaining SMART Spaces?

☐ Yes
☐ No

Did you visit the website for SMART Spaces?

☐ Yes
☐ No

Did you receive specific guidance directly from the SMART Spaces team on how to change your normal teaching practice, outside of the SMART Spaces lessons?

☐ Yes
☐ No

Have the teachers in your department who are involved in the SMART Spaces pilot worked together to think about changing normal practice (beyond the SMART Spaces lessons)?

☐ Yes
☐ No

How far do you agree with these statements about the training and support?

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly Agree
The training provided me with everything I needed to deliver SMART Spaces.	☐	☐	☐	☐	☐
The support visit was useful in furthering my delivery of SMART Spaces.	☐	☐	☐	☐	☐
The handbook detailed everything I needed to know about SMART Spaces.	☐	☐	☐	☐	☐
The website was useful to me.	☐	☐	☐	☐	☐
The guidance from the SMART Spaces team around changing normal practice was helpful.	☐	☐	☐	☐	☐

How far do you agree with these statements about the SMART Spaces slides for AQA Chemistry Paper 1 content?

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree	I did not deliver the Paper 1 slides
The SMART Spaces slides for Paper 1 provided a high quality revision resource.	☐	☐	☐	☐	☐	☐
The SMART Spaces slides for Paper 1 covered the relevant AQA chemistry content well.	☐	☐	☐	☐	☐	☐
The slides for Paper 1 were well timed to fit within an hour, with two spaces.	☐	☐	☐	☐	☐	☐

Now please tell us how far you agree with these statements about the SMART Spaces slides which covered the AQA Chemistry Paper 2 content:

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree	I did not deliver the Paper 2 slides
The SMART Spaces slides for Paper 2 provided a high quality revision resource.	☐	☐	☐	☐	☐	☐
The SMART Spaces slides for Paper 2 covered the relevant AQA chemistry content well.	☐	☐	☐	☐	☐	☐
The slides for Paper 2 were well timed to fit within an hour, with two spaces.	☐	☐	☐	☐	☐	☐

These questions help us to understand the costs and time commitment involved in delivering SMART Spaces.

Did you or your school incur any financial cost for you to attend training around SMART Spaces?

- ☐ Yes
☐ No

Please provide an estimate of this cost:

Did you or your school incur any additional cost in buying new equipment or resources in order to deliver SMART Spaces to your classes? (e.g. a powerpoint remote or resources for spacing activities).

- ☐ Yes
☐ No

Please provide an estimate of this cost:

Did your school have to provide cover for you in order for you to train or deliver SMART Spaces?

- ☐ Yes
☐ No

Please tell us the approximate number of hours of cover (as a numerical value):

These questions provide an opportunity to feed back anything else about SMART Spaces.

What do you like about SMART Spaces?

What do you not like about SMART Spaces?

Is there anything else that you would like to tell us about SMART Spaces?

Smart Spaces Pilot, Student Survey

You previously received an information letter about the SMART Spaces project. Your teacher(s) have been modifying their teaching to use a set of slides, and spaces between them, which should help you remember things more quickly in GCSE chemistry. To see whether this makes a difference, we are now asking you to fill out a short survey about how you use your time in chemistry and what you think about it. We are asking for your name and school only so that we can match up the surveys at the start and the end of the trial. We will remove all names when we look at surveys and in any reports of what we find out.

1) First Name

2) Surname

3) School Name

4) Today's Date (click Today button)

How often in your chemistry lessons and chemistry homework do you do the following? (select one option per row)

	Almost never	Occasionally	Fairly often	Most of the time	Almost always
5) Learn about ideas and theories in chemistry.	☐	☐	☐	☐	☐
6) Revisit or revise ideas and theories.	☐	☐	☐	☐	☐
7) Learn about experiments and processes.	☐	☐	☐	☐	☐
8) Use equations or do calculations.	☐	☐	☐	☐	☐
9) Develop a prediction, hypothesis or explanation.	☐	☐	☐	☐	☐
10) Plan or do scientific investigations or experiments.	☐	☐	☐	☐	☐
11) Work with data or graphs.	☐	☐	☐	☐	☐
12) Identify patterns and draw conclusions.	☐	☐	☐	☐	☐
13) Evaluate investigations to suggest improvements.	☐	☐	☐	☐	☐
14) Discuss how ideas, theories and models in chemistry are developed and change over time.	☐	☐	☐	☐	☐
15) Consider the role of chemistry in real world situations and technologies.	☐	☐	☐	☐	☐
16)					

Consider jobs that involve chemistry, or what scientists do.	☐	☐	☐	☐	☐
17) Discuss problems in the world, and the role that chemistry might play.	☐	☐	☐	☐	☐

How do you feel about your own ability in chemistry at the moment? (select one option per row)

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
18) I find chemistry difficult	☐	☐	☐	☐	☐
19) I am just not good at chemistry	☐	☐	☐	☐	☐
20) I get good marks in chemistry	☐	☐	☐	☐	☐
21) I learn chemistry quickly	☐	☐	☐	☐	☐
22) Chemistry is one of my best subjects	☐	☐	☐	☐	☐
23) I feel helpless when doing chemistry	☐	☐	☐	☐	☐
24) In my chemistry class, I understand everything	☐	☐	☐	☐	☐

How far do you agree with these statements about chemistry? (select one option per row)

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
25) Chemistry is a set of fixed ideas.	☐	☐	☐	☐	☐
26) Chemistry is important for society.	☐	☐	☐	☐	☐
27) Chemistry makes our lives easier and more comfortable.	☐	☐	☐	☐	☐
28) The benefits of chemistry are greater than the harmful effects.	☐	☐	☐	☐	☐
29) Ideas in chemistry change as scientists find new evidence.	☐	☐	☐	☐	☐

SMART Space pilot, pupil engagement survey

- 1) Each time you do SMART Spaces you do a block of three lessons in a row, where you repeat the same slides. How many blocks of three lessons have you done for SMART spaces?
- ☐ 1 block of 3 lessons
☐ 2 blocks of 3 lessons
☐ 3 blocks of 3 lessons
☐ 4 blocks of 3 lessons
☐ 5 blocks of 3 lessons
☐ More than 5 blocks of 3 lessons
- 2) Out of the [number_blocks], how many blocks have been to revise things that you have learnt about before in class? Please enter a number. _____

These questions are about how you felt about the SMART Spaces Lessons.

	Strongly Disagree	Disagree	Neither agree or disagree	Agree	Strongly Agree
3) I was enthusiastic to try SMART Spaces	☐	☐	☐	☐	☐
4) The SMART Spaces lessons helped me learn more easily than normal lessons	☐	☐	☐	☐	☐
5) I think SMART Spaces works well for revision	☐	☐	☐	☐	☐
6) I think SMART Spaces works well for learning new things	☐	☐	☐	☐	☐
7) I felt more motivated to learn during SMART Spaces than in normal classes	☐	☐	☐	☐	☐
8) I think SMART Spaces would be useful for other subjects	☐	☐	☐	☐	☐
9) I found the SMART Spaces lessons fun	☐	☐	☐	☐	☐
10) I found the SMART Spaces lessons helpful for revision	☐	☐	☐	☐	☐
11) I found the SMART Spaces lessons helpful for understanding things I have not learnt about before	☐	☐	☐	☐	☐

These questions are about how SMART Spaces affected your other chemistry lessons. How far do you agree with these statements?

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
12)					

After SMART spaces blocks, I was able to learn new things more easily.

☐☐☐☐☐

13) I was able to apply what I learnt in SMART spaces straight away.

☐☐☐☐☐

14) Overall, it was worth taking time out of 'normal lessons' to do SMART spaces.

☐☐☐☐☐

15) What did you like about SMART Spaces?

16) What did you not like about SMART spaces?

17) Is there anything else that you would like to tell us about SMART Spaces?

Appendix 3 – Protocol for Case Study Visit to Pilot Schools

Context of visit

Is this a support visit, a 1st SMART spaces block (if so which day of 3?), or both? Are you seeing normal practice too?

How many teachers? Which teachers – HoD, chemistry specialists etc?

Are there any contextual issues in the school? Change of staff, leadership?

etc

Observation of SMART lesson.

[write a timeline of what happens, mostly to gauge timings for fidelity]

How receptive are the class? What are the indicators of this?

Are there any behavioural issues? How are these pre-empted or dealt with?

How far is the teacher embellishing what is on the slides? How far is this related to the teaching context and history of interaction with the class?

Does the teacher seem confident?

What questioning techniques does the teacher use, if any?

What happens during the spacing activity? How well planned for and organised is this?

Anything else noteworthy?

Observation of ‘normal practice’

[record a brief timeline of activities - this is mostly to get a feel for the balance of teaching content A01; application A02 and enquiry A03. Also to stimulate interview points below.]

If the ‘normal lesson’ follow a SMART spaces session, then does the teacher make any adjustments according to the priming? E.g. refer to slides, move more quickly through content.

Does the teacher use assessment to gauge understanding or assume it?

Does the teacher move on after assessing or repeat content anyway?

Interview - Your normal practice in teaching chemistry.

[ideally, we would have teacher’s survey responses to hand. Where possible, draw on prompts from the lesson observed]

'these first few questions help us consolidate the survey responses about normal practice, but also allow us to go further into the reasons for the responses'

How often in lessons do the class focus on learning new content chemistry? A01

What do you think leads to this? National curriculum/specification/school scheme/other pressure/current knowledge of pupils/own views about teaching etc

How often do they apply that knowledge? To new situations? To 'real world problems'? A02

What do you think leads to this? National curriculum/specification/school scheme/other pressure/current knowledge of pupils/own views about teaching etc

How often do pupils engage in enquiry? A03

What do you think leads to this? National curriculum/specification/school scheme/other pressure/current knowledge of pupils/own views about teaching etc

Other comments

The amount of time taken on planning and curriculum across the school system is a real issue.

Your impressions of SMART Spaces so far.

What do you like about SMART spaces within your classroom teaching? What potential do you see in it?

How important is the evidence base behind the approach?

How important are the resources supplied?

Did you see yourself making any modifications to the way the SMART spaces sessions run?

What; why?

What barriers do you see to making it work in your school?

What barriers do you see to making it work in other schools?

What might change in your teaching or come next after SMART Spaces sessions?

Any other points of note for our evaluation?

Meaning making

SMART Spaces is an interesting approach in that it introduces students to knowledge perhaps before they have had chance to explore the meaning.

How do pupils initially respond to things that they have not seen before?

In your later lessons, do you notice anything different in how the students respond to the things covered in the SMART Spaces slides?

Do you do anything different in your teaching?

What; why?

Appendix 4a – Aggregate Teacher Survey Data

1. Comparing time-usage pre- and post-intervention: evidence of promise in changing teaching practice

These are the findings of independent samples. There are only 13 matched samples which is insufficient for statistical analysis, so the below is not reported in the pilot report.

Comparing pre- and post-intervention teachers	Pre-mean (SD) n = 28	Post-mean (SD) n = 17
Learn about ideas and theories in chemistry (AO1).	2.50 (1.17)	2.53 (0.87)
Revisit or revise ideas and theories (AO1).	2.43 (0.96)	2.71 (0.92)
Learn about experiments and processes (AO1).	2.67 (0.78)	2.41 (0.80)
Use equations or do calculations (AO2).	2.46 (0.79)	2.12 (0.70)
Develop a prediction, hypothesis or explanation (AO2).	1.75 (0.89)	1.71 (0.69)
Plan or do scientific investigations or experiments (AO2).	2.14 (0.85)	1.71 (0.69)
Work with data or graphs (AO3).	2.22 (0.64)	2.06 (0.75)
Identify patterns and draw conclusions (AO3).	2.14 (0.89)	2.18 (0.73)
Evaluate investigations to suggest improvements (AO3).	1.54 (0.79)	1.76 (0.75)
Discuss how ideas, etc... in chemistry are developed and change over time (WS).	1.79 (1.07)	1.65 (0.79)
Consider the role of chemistry in real world situations and technologies (WS).	2.04 (1.00)	1.71 (0.99)
Consider jobs that involve chemistry, or what scientists do (WS).	1.50 (1.00)	1.18 (0.95)
Discuss problems in the world, and the role that chemistry might play (WS).	1.71 (0.94)	1.53 (0.94)

2. Organisation, departmental and institutional support for SMART Spaces (HoDs/SMART leads only)

HoD/SMART leads only (n = 8)	Missing	Disagree/ Strongly disagree	Neither agree nor disagree	Agree/ Strongly Agree
It has been easy to organise teaching to fit the SMART Spaces lessons covering AQA Chemistry Paper 1 in	0	2	1	5
It has been easy to organise teaching to fit the SMART Spaces lessons covering AQA Chemistry Paper 2 in	0	4	2	2
Overall, the department benefited from including SMART Spaces within teaching.	0	1	3	4
We would use SMART Spaces in the future as part of our revision with Year 10.	0	2	0	6
We would use SMART Spaces in the future as part of our revision with Year 11.	0	1	1	6
We would use SMART Spaces in the future prior to teaching the content of the slides.	0	2	3	3
Senior leaders were supportive of the SMART Spaces intervention.	0	0	2	6
The SMART Spaces team provided everything we needed to run the intervention as a department.	0	0	0	8
We would be happy to use SMART Spaces in biology and physics too.	0	0	2	6
The SMART Spaces team provided helpful guidance in how we might change normal practice [...].	0	0	2	6

3. Fidelity in relation to training and support

Did you attend a training session for SMART spaces?	Missing %	No %	Yes %
Head/SMART leads, n = 8	0	0	8
All other teachers, n = 8	0	2	6
Total, n = 16	0	2	14

Did you receive a support visit in which a member of the SMART Spaces team provided feedback on part of a practice lesson?	Missing %	No %	Yes %
Head/SMART leads, n = 8	0	0	8
All other teachers, n = 8	0	1	7
Total, n = 16	0	1	15

Did you receive a handbook explaining SMART Spaces?	Missing %	No %	Yes %
Head/SMART leads, n = 8	0	1	7
All other teachers, n = 8	0	3	5
Total, n = 16	0	4	12

Did you visit the website for SMART Spaces?	Missing %	No %	Yes %
Head/SMART leads, n = 8	0	0	8
All other teachers, n = 8	0	5	3

Total, n = 16	0	5	11
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Did you receive specific guidance directly from the SMART Spaces team on how to change your normal teaching practice, outside of the SMART Spaces lessons?	Missing %	No %	Yes %
Head/SMART leads, n = 8	0	2	6
All other teachers, n = 8	0	4	4
Total, n = 16	0	6	10

Have the teachers in your department worked together to think about changing normal practice (beyond the SMART Spaces lessons)?	Missing %	No %	Yes %
Head/SMART leads, n = 8	0	1	7
All other teachers, n = 8	0	4	4
Total, n = 16	0	5	11

4. Fidelity of implementation of the teaching programme

4. a) Fidelity/Dosage of implementing the blocks for Papers 1 and 2

AQA Paper 1	Frequency
1 block of three lessons	1
2 blocks of three lessons	4
3 blocks of three lessons	11
Total	16

AQA Paper 2	Frequency
1 block of three lessons	4
2 blocks of three lessons	1
3 blocks of three lessons	2
Missing	9
Total	16

4. b) Fidelity of implementing the SMART Spaces lessons including spacing

For Head/SMART leads, teacher-classes n = 15. Average of 1.875 classes per HoD/SMART lead.

For all other teachers, teacher-classes n = 12. Average of 1.5 classes per science teacher.

How far did you explain the idea behind SMART Spaces?	Missing (%)	Not at all (%)	A little (%)	In detail (%)
Head/SMART leads, n = 15	0	0	4 (26.7)	11 (73.3)
All other teachers, n = 12	0	1 (8.3)	4 (33.3)	7 (58.3)
Total, n = 27	0	1 (3.7)	8 (29.6)	18 (66.7)

Did you cover all the slides in each lesson or skip some?	Missing (%)	Skipped some in every lesson (%)	Skipped some in some lessons (%)	Cover all slides (%)
Head/SMART leads, n = 15	0	0	4 (26.7)	11 (73.3)
All other teachers, n = 12	0	6 (50.0)	2 (16.7)	4 (33.3)
Total, n = 27	0	6 (22.2)	6 (22.2)	15 (55.6)

Did you change the language used?	Missing %	No %	Yes %
Head/SMART leads, n = 15	0	10 (66.7)	5 (33.3)
All other teachers, n = 12	0	7 (58.3)	5 (41.7)
Total, n = 27	0	17 (63.0)	10 (37.0)

Did you change the content (text/image)?	Missing %	No %	Yes %
Head/SMART leads, n = 15	0	10 (66.7)	5 (33.3)
All other teachers, n = 12	0	12 (100)	0
Total, n = 27	0	22 (81.5)	5 (18.5)

Did you change the order of the slides presented?	Missing %	No %	Yes %
Head/SMART leads, n = 15	0	9 (60)	6 (40)
All other teachers, n = 12	0	9 (75)	3 (25)
Total, n = 27	0	18 (66.7)	9 (33.3)

I taught the lessons on separate days	Missing %	No %	Yes %
Head/SMART leads, n = 15	0	0	15 (100)
All other teachers, n = 12	0	0	12 (100)
Total, n = 27	0	0	27 (100)

I taught each set of lessons over no more than one week	Missing %	No %	Yes %
Head/SMART leads, n = 15	0	0	15 (100)
All other teachers, n = 12	0	3 (25)	9 (75)
Total, n = 27	0	3 (11.1)	24 (88.9)

How long were the lessons?	Missing	less than 60 mins	60 mins	more than 60 mins
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Head/SMART leads, n = 15	0	13 (86.7)	2 (13.3)	0
All other teachers, n = 12	0	4 (33.3)	8 (66.7)	0
Total, n = 27	0	17 (63.0)	10 (37.0)	0

What spacing activities did you do?	Juggling	Plasticine modelling	Origami	Plate spinning	Balloon games	Other
Head/SMART leads, n = 15	5 (33.3)	0	5 (33.3)	0	0	13 (86.7)
All other teachers, n = 12	3 (25)	1 (8.3)	3 (25)	0	0	10 (83.3)
Total, n = 27	8 (29.6)	1 (3.7)	8 (29.6)	0	0	23 (85.2)

How many of the six lessons did you teach using the spacing lessons as intended?	Missing %	I omitted a spacing activity for 3+ lessons, %	I omitted a spacing activity for one or two lessons, %	I taught all 6 lessons with spacing activities as intended, %
Head/SMART leads, n = 15	0	0	4 (26.7)	11 (73.3)
All other teachers, n = 12	0	0	0	12 (100)
Total, n = 27	0	0	4 (14.8)	23 (85.2)

5. Teacher perceptions of SMART Spaces training and support

Comparing perceptions of training and support for 'HoD/SMART leads only' with 'All other teachers'

HoD/SMART leads only (n = 8)	Missing data	Disagree/Strongly disagree	Neither agree nor disagree	Agree/Strongly Agree
The training provided me with everything I needed to deliver SMART Spaces.	0	0	0	8
The support visit was useful in furthering my delivery of SMART Spaces	0	0	1	7
The handbook detailed everything I needed to know about SMART Spaces.	1	0	0	7
The website was useful to me.	0	0	1	7
The guidance from the SMART Spaces team on changing normal practice was helpful.	2	0	2	4

All other teachers (n = 8)	Missing data	Disagree/Strongly disagree	Neither agree nor disagree	Agree/Strongly Agree
The training provided me with everything I needed to deliver SMART Spaces.	2	0	0	6
The support visit was useful in furthering my delivery of SMART Spaces	1	1	1	5
The handbook detailed everything I needed to know about SMART Spaces.	3	0	1	4
The website was useful to me.	5	0	1	2
The guidance from the SMART Spaces team on changing normal practice was helpful.	4	0	2	2

HoD/SMART leads only (n = 8)	Missing	Disagree/ Strongly disagree	Neither agree nor disagree	Agree/ Strongly Agree
SMART Spaces has the potential to speed up how quickly pupils gain knowledge and understanding in chemistry (AO1).	0	0	4	4
SMART Spaces has the potential to allow me to focus more on applying knowledge and understanding (AO2) in my chemistry teaching.	0	2	3	3
SMART Spaces has the potential to allow me to focus more on analysing information and ideas (AO3) in my chemistry teaching.	0	1	5	2
Overall, it is worthwhile taking lessons to incorporate SMART Spaces into teaching chemistry.	0	0	2	6

6. Teacher perceptions of usefulness of SMART Spaces for AO strands and high vs low attainers

Other teachers (n = 8)	Missing	Disagree/ Strongly disagree	Neither agree nor disagree	Agree/ Strongly Agree
SMART Spaces has the potential to speed up how quickly pupils gain knowledge and understanding in chemistry (AO1).	0	2	2	4
SMART Spaces has the potential to allow me to focus more on applying knowledge and understanding (AO2) in my chemistry teaching.	0	2	1	5
SMART Spaces has the potential to allow me to focus more on analysing information and ideas (AO3) in my chemistry teaching.	0	3	1	4
Overall, it is worthwhile taking lessons to incorporate SMART Spaces into teaching chemistry.	0	3	1	4

SMART Spaces is more useful for high attainers?	Missing data	Disagree/ Strongly disagree	Neither agree nor disagree	Agree/ Strongly Agree
HoD/SMART leads (n = 8)	2	1	1	4
Other teachers (n = 8)	5	1	0	2
Total (n = 16)	7	2	1	6

7. Teacher perceptions of the quality of SMART resources for Papers 1 and 2

Comparing teacher perceptions of the quality of SMART resources for 'HoD/SMART leads only' with 'All other teachers'

HoD/SMART leads only (n = 8)	Missing	I did not deliver the Paper 1/2 slides	Disagree/Strongly disagree	Neither agree or disagree	Agree/Strongly Agree
The SMART Spaces slides for Paper 1 provided a high-quality revision resource.	0	0	0	2	6
The SMART Spaces slides for Paper 1 covered the relevant AQA chemistry content well.	0	0	0	1	7
The slides for Paper 1 were well timed to fit within an hour, with two spaces.	0	0	2	1	5
The SMART Spaces slides for Paper 2 provided a high-quality revision resource.	0	1	1	3	3
The SMART Spaces slides for Paper 2 covered the relevant AQA chemistry content well.	0	1	0	3	4
The slides for Paper 2 were well timed to fit within an hour, with two spaces.	0	1	1	3	3

All other teachers (n = 8)	Missing	I did not deliver the Paper 1/2 slides	Disagree/Strongly disagree	Neither agree or disagree	Agree/Strongly Agree
The SMART Spaces slides for Paper 1 provided a high-quality revision resource.	0	0	0	2	6
The SMART Spaces slides for Paper 1 covered the relevant AQA chemistry content well.	0	0	0	1	7
The slides for Paper 1 were well timed to fit within an hour, with two spaces.	0	0	3	0	5
The SMART Spaces slides for Paper 2 provided a high-quality revision resource.	1	5	0	0	2
The SMART Spaces slides for Paper 2 covered the relevant AQA chemistry content well.	1	5	0	0	2
The slides for Paper 2 were well timed to fit within an hour, with two spaces.	1	5	0	0	2

8. Teacher engagement with the intervention

Comparing teacher engagement with the intervention for 'HoD/SMART leads only' with 'All other teachers'

HoD/SMART leads only (n = 8)	Missing data	Disagree/ Strongly disagree	Neither agree nor disagree	Agree/ Strongly Agree
I was confident in delivering SMART Spaces	0	0	0	8
My class/classes were enthusiastic to try SMART Spaces	0	1	2	5
The SMART Spaces lessons helped the class learn more easily than normal lessons.	0	1	3	4
I think SMART Spaces works well for revision	0	1	1	6
I think SMART Spaces works well for learning new things	0	3	4	1
The class/classes as a whole enjoyed SMART Spaces.	0	0	3	5
The class seemed more motivated to learn during SMART Spaces than in normal lessons	0	3	4	1
I would be happy to deliver SMART Spaces again in the future	0	0	2	6
I think SMART Spaces would be useful for other subjects, beyond chemistry	0	0	1	7
My class/classes found the SMART Spaces lessons fun	0	2	3	3
My class/classes found the SMART Spaces lessons helpful for revision	0	1	2	5
My class/classes found the SMART Spaces lessons helpful for understanding things that they have not learnt before	0	2	3	3
The evidence behind SMART Spaces was important in my wanting to use it	0	0	1	7

Other teachers (n = 8)	Missing data	Disagree/ Strongly disagree	Neither agree nor disagree	Agree/ Strongly Agree
I was confident in delivering SMART Spaces	0	1	0	7
My class/classes were enthusiastic to try SMART Spaces	0	1	1	6
The SMART Spaces lessons helped the class learn more easily than normal lessons.	0	2	4	2
I think SMART Spaces works well for revision	0	1	0	7
I think SMART Spaces works well for learning new things	0	4	2	2
The class/classes as a whole enjoyed SMART Spaces.	0	3	0	5
The class seemed more motivated to learn during SMART Spaces than in normal lessons	0	4	4	0
I would be happy to deliver SMART Spaces again in the future	0	3	2	3
I think SMART Spaces would be useful for other subjects, beyond chemistry	0	1	2	5
My class(es) found the SMART Spaces lessons fun	0	3	1	4
My class(es) found the SMART Spaces lessons helpful for revision	0	1	1	6
My class(es) found the SMART Spaces lessons helpful for understanding things that they have not learnt before	0	5	2	1
The evidence behind SMART Spaces was important in my wanting to use it	0	1	3	4

Appendix 4b – Aggregate Pupil Survey Data

1. Comparing time-usage pre- and post-intervention: evidence of promise in changing teaching practice

Comparing time-usage pre- and post-intervention using the overall pupil survey sample: matched samples t-test

Comparing pre- and post-intervention pupils	n	Pre-mean (SD)	Post-mean (SD)	Effect size cohen's D	C.I. for Effect size
Learn about ideas and theories in chemistry.	164	1.90 (1.03)	1.95 (1.08)	0.04	-0.12, 0.19
Revisit or revise ideas and theories.	165	1.78 (1.01)	1.89 (0.99)	0.10	-0.05, 0.26
Learn about experiments and processes.	165	2.45 (1.00)	2.15 (1.05)	-0.30	-0.45, -0.14
Use equations or do calculations.	165	2.58 (1.07)	2.42 (1.07)	-0.13	-0.28, 0.03
Develop a prediction, hypothesis or explanation.	162	1.78 (1.12)	1.78 (1.13)	0.00	-0.15, 0.15
Plan or do scientific investigations or experiments.	165	2.17 (1.11)	1.82 (1.11)	-0.31	-0.47, -0.15
Work with data or graphs.	164	2.02 (1.03)	2.07 (1.00)	0.04	-0.12, 0.19
Identify patterns and draw conclusions.	165	1.57 (1.03)	1.69 (1.14)	0.10	-0.05, 0.25
Evaluate investigations to suggest improvements.	164	1.59 (1.01)	1.60 (1.05)	0.01	-0.14, 0.16
Discuss how ideas, etc... in chemistry are developed and change over time.	165	1.64 (1.02)	1.93 (1.06)	0.25	0.10, 0.41
Consider the role of chemistry in real world situations and technologies.	165	1.23 (1.10)	1.21 (1.05)	-0.01	-0.17, 0.14
Consider jobs that involve chemistry, or what scientists do.	164	0.76 (0.95)	0.82 (0.94)	0.05	-0.11, 0.20
Discuss problems in the world, and the role that chemistry might play.	165	1.04 (1.10)	1.07 (1.11)	0.02	-0.14, 0.17

Matched samples pre- and post-intervention pupils	Mean diff	S.E.	C.I.		t	df	p
			Lower	Upper			
Learn about ideas and theories in chemistry.	0.04	0.09	-0.13	0.22	0.49	163	0.63
Revisit or revise ideas and theories.	0.12	0.09	-0.06	0.29	1.33	164	0.19
Learn about experiments and processes.	-0.30	0.08	-0.46	-0.15	-3.81	164	<0.001
Use equations or do calculations.	-0.16	0.10	-0.35	0.04	-1.61	164	0.11
Develop a prediction, hypothesis or explanation.	0.00	0.09	-0.17	0.17	0.00	161	1.00
Plan or do scientific investigations or experiments.	-0.35	0.09	-0.53	-0.18	-3.99	164	<0.001
Work with data or graphs.	0.04	0.09	-0.13	0.22	0.49	163	0.63

Identify patterns and draw conclusions.	0.12	0.09	-0.06	0.31	1.31	164	0.19
Evaluate investigations to suggest improvements.	0.01	0.10	-0.18	0.20	0.13	163	0.90
Discuss how ideas, etc... in chemistry are developed and change over time.	0.29	0.09	0.11	0.47	3.23	164	<0.005
Consider the role of chemistry in real world situations and technologies.	-0.02	0.10	-0.21	0.18	-0.19	164	0.85
Consider jobs that involve chemistry, or what scientists do.	0.06	0.10	-0.13	0.24	0.58	163	0.57
Discuss problems in the world, and the role that chemistry might play.	0.02	0.11	-0.18	0.23	0.23	164	0.82

2. Comparing chemistry self-concept pre- and post-intervention

Comparing chemistry self-concept pre- and post-intervention using the overall pupil survey sample: matched samples t-test

Scored: SD = -2, D = -1, NAD = 0, A = 1, SA = 2

Comparing pre- and post-intervention pupils	n	Pre-mean (SD)	Post-mean (SD)	Effect size Cohen's D	Lower CI	Upper CI
I find chemistry difficult	163	0.56 (0.96)	0.47 (1.04)	-.088	-.242	.066
I am just not good at chemistry	165	0.40 (1.07)	0.39 (1.16)	-.011	-.164	.141
I get good marks in chemistry	165	-0.19 (0.92)	-0.22 (1.00)	-.033	-.186	.120
I learn chemistry quickly	165	-0.52 (0.99)	-0.64 (1.01)	-.117	-.270	.036
Chemistry is one of my best subjects	165	-1.01 (1.06)	-0.92 (1.09)	.083	-.070	.236
I feel helpless when doing chemistry	164	-0.03 (1.09)	-0.02 (1.14)	.010	-.143	.163
In my chemistry class, I understand everything	165	-0.84 (0.93)	-0.96 (1.02)	-.112	-.264	.042

Matched samples pre- and post-intervention pupils	Mean diff	S.E.	C.I.		t	df	p
			Lower	Upper			
I find chemistry difficult	-.086	.077	-.237	.065	-1.122	162	0.26
I am just not good at chemistry	-.012	.085	-.179	.155	-.143	164	.886
I get good marks in chemistry	-.036	.086	-.206	.133	-.423	164	.673

I learn chemistry quickly	-.121	.081	-.280	.038	-1.505	164	.134
Chemistry is one of my best subjects	.097	.091	-.082	.276	1.070	164	.286
I feel helpless when doing chemistry	.012	.099	-.184	.208	.123	163	.902
In my chemistry class, I understand everything	-.115	.080	-.274	.044	-1.433	164	.154

3. Comparing beliefs about chemistry pre- and post-intervention

Comparing beliefs about chemistry pre- and post-intervention using the overall pupil survey sample: matched samples t-test

Scored: SD = -2, D = -1, NAD = 0, A = 1, SA = 2

Comparing pre- and post-intervention pupils	Post n	Pre-mean (SD)	Post-mean (SD)	Effect size Cohen's D	Lower CI	Upper CI
Chemistry is a set of fixed ideas	165	-0.03 (0.81)	0.05 (0.87)	.071	-.082	.224
Chemistry is important for society	165	0.27 (0.96)	0.13 (1.06)	-.114	-.267	.039
Chemistry makes our lives easier and more comfortable	165	0.01 (0.96)	-0.07 (0.93)	-.082	-.234	.071
The benefits of chemistry are greater than the harmful effects	164	0.14 (0.82)	0.07 (0.75)	-.073	-.226	.081
Ideas in chemistry change as scientists find new evidence	165	0.62 (0.90)	0.54 (0.99)	-.079	-.231	.074

Matched samples pre- and post-intervention pupils	Mean diff	S.E.	C.I.		t	df	p
			Lower	Upper			
Chemistry is a set of fixed ideas	.079	.086	-.091	.249	.917	164	.361
Chemistry is important for society	-.139	.095	-.328	.049	-1.463	164	.145
Chemistry makes our lives easier and more comfortable	-.085	.081	-.244	.075	-1.050	164	.295
The benefits of chemistry are greater than the harmful effects	-.073	.079	-.228	.082	-.931	163	.353
Ideas in chemistry change as scientists find new evidence	-.085	.084	-.251	.081	-1.010	164	.314

4. Fidelity of implementation and pupil engagement with the intervention

4. a) Fidelity/Dosage of implementing the blocks

How many blocks have you done?	Percentage n = 250
1 block of three lessons	10.8

2 blocks of three lessons	27.6
3 blocks of three lessons	43.6
4 blocks of three lessons	3.2
5 blocks of three lessons	0
+5 blocks of three lessons	1.6
Missing	13.2
Total	100.0

Of those blocks, how many have been revising things that you have learnt before?	% of pupils n = 250
Almost none, <10%	3.6
Small minority, 10% ≤ and < 35%	1.2
About half, 35% ≤ and <65%	3.2
Large majority, 65% ≤ and <90%	9.6
Almost all, ≥ 90%	62.0
Missing	20.4
Total	100.0

4. b) Pupil engagement in the intervention

Post-intervention, all pupils n = 250	Missing data %	Disagree/ Strongly disagree %	Neither agree nor disagree %	Agree/ Strongly Agree %
I was enthusiastic to try SMART Spaces	6.8	27.2	31.2	34.8
The SMART Spaces lessons helped me learn more easily than normal lessons.	6.4	26.0	26.4	41.2
I think SMART Spaces works well for revision	6.8	22.4	23.2	47.6
I think SMART Spaces works well for learning new things	6.0	25.6	28.4	40.0
I felt more motivated to learn during SMART Spaces than in normal lessons	6.0	33.6	25.2	35.2
I think SMART Spaces would be useful for other subjects	6.4	20.8	22.4	50.4
I found the SMART Spaces lessons fun	6.4	30.0	25.2	38.4
I found the SMART Spaces lessons helpful for revision	6.0	23.2	24.0	46.8
I found the SMART Spaces lessons helpful for understanding that I have not learnt before	6.0	30.0	25.2	38.8
After SMART Spaces blocks, I was able to learn new things more easily (n = 91)	4.4	20.9	36.3	38.5
I was able to apply what I learnt in SMART Spaces straight away (n = 91)	3.3	25.3	36.3	35.2
Overall, it was worth taking time out of 'normal lessons' to do SMART Spaces (n = 91)	3.3	9.9	20.9	65.9

5. Qualitative analysis of open-ended questions from the survey

Things pupils like about SMART:

- They think SMART Spaces is effective and efficient for revision
- They like the breaks because:
 - o They provided a change in activity
 - o They provided recovery time (from intense concentration)
 - o They let things 'sink in'
 - o They like the distraction activities (juggling)
 - o They like having a break/doing no work
- A few liked the repetition
- Two liked SMART for learning new things (but far outweighed by positive comments regarding SMART for revision)
- They think SMART is 'fun'/engaging/enjoyable
- Two or three commented that it was good to try something new
- They think SMART is 'helpful' (though unspecified for what)
- Two indicated some kind of increased positivity e.g. "rewarding"; "it gives you a target"
- One enjoyed competing to shout out answers
- One said 'more inclusive'
- One said writing in answers; one said not writing much

Things pupils didn't like about SMART

- That it's only in chemistry. 15 commented that it would be useful in other subjects: several specified sciences; a couple maths; one English
- Sessions feeling too rushed/fast or pressured
- Some wanted longer breaks but one said returning to learning after the break was difficult.
- They didn't like the break-time activities or they wanted more of them
- A couple didn't like the repetition
- Various with regard to teaching style and behaviour management
 - o Not enough interactivity; too much teacher-talk
 - o Other pupils calling out
 - o Wanted more practicals/live demos
- One said it wasn't very good for learning new ideas
- A few commented too much content
- A few said it was not fun/boring/a waste of time/ unhelpful (unspecified)
- One said "immaturity from the teacher"

One said "I feel extremely uncomfortable" but did not say why

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