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Sheffield Hallam University | Sheffield Institute of Education

Learning from the Wellcome programme: Supporting science teachers to engage with and carry out research

Chartered College of Teaching

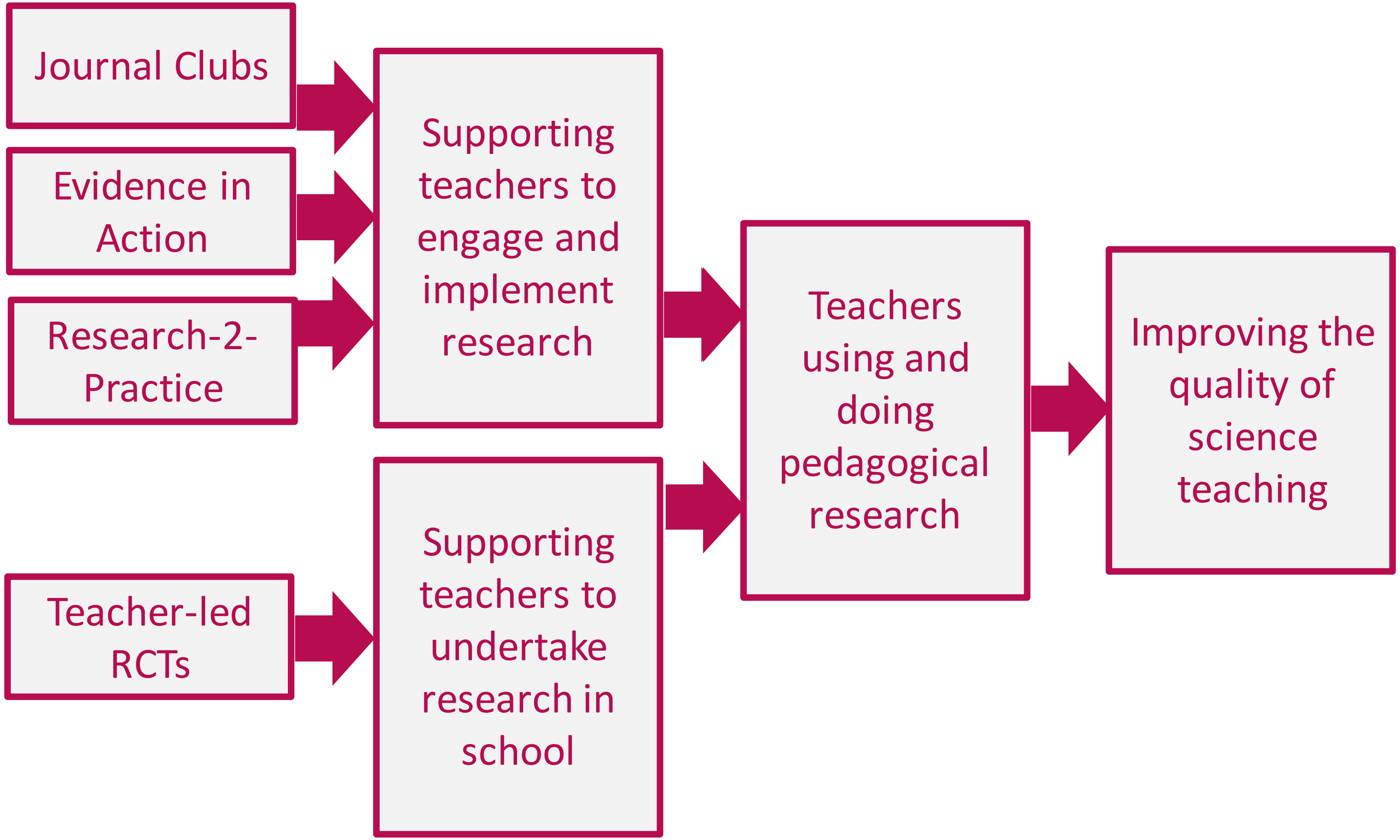
University of Roehampton London

Education Development Trust

STEM Learning

The Behavioural Insights Team

The Wellcome programme



Learning from the Wellcome programme

1. Introduction to each project
    - Journal Clubs
    - Research-2-Practice
    - Evidence in Action
    - Teacher-led RCTs

2. Research Findings and Implications
3. Findings Q&A

4. Project 'Market Place'

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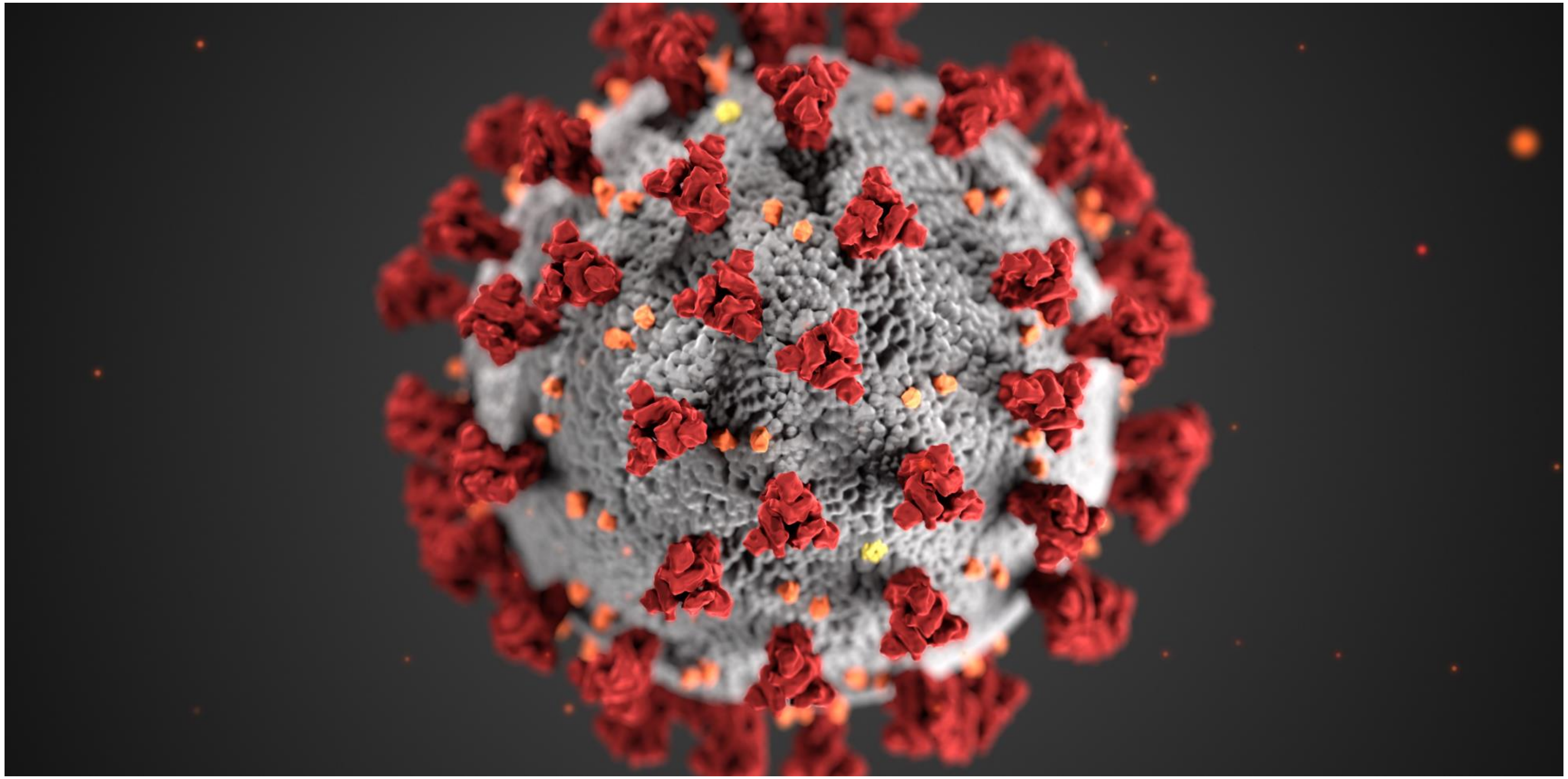
Impact of the Covid-19 pandemic



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TEACHER JOURNAL CLUBS

Presented by:

Dr Lisa-Maria Muller

21/09/2022

CHARTERED COLLEGE OF TEACHING

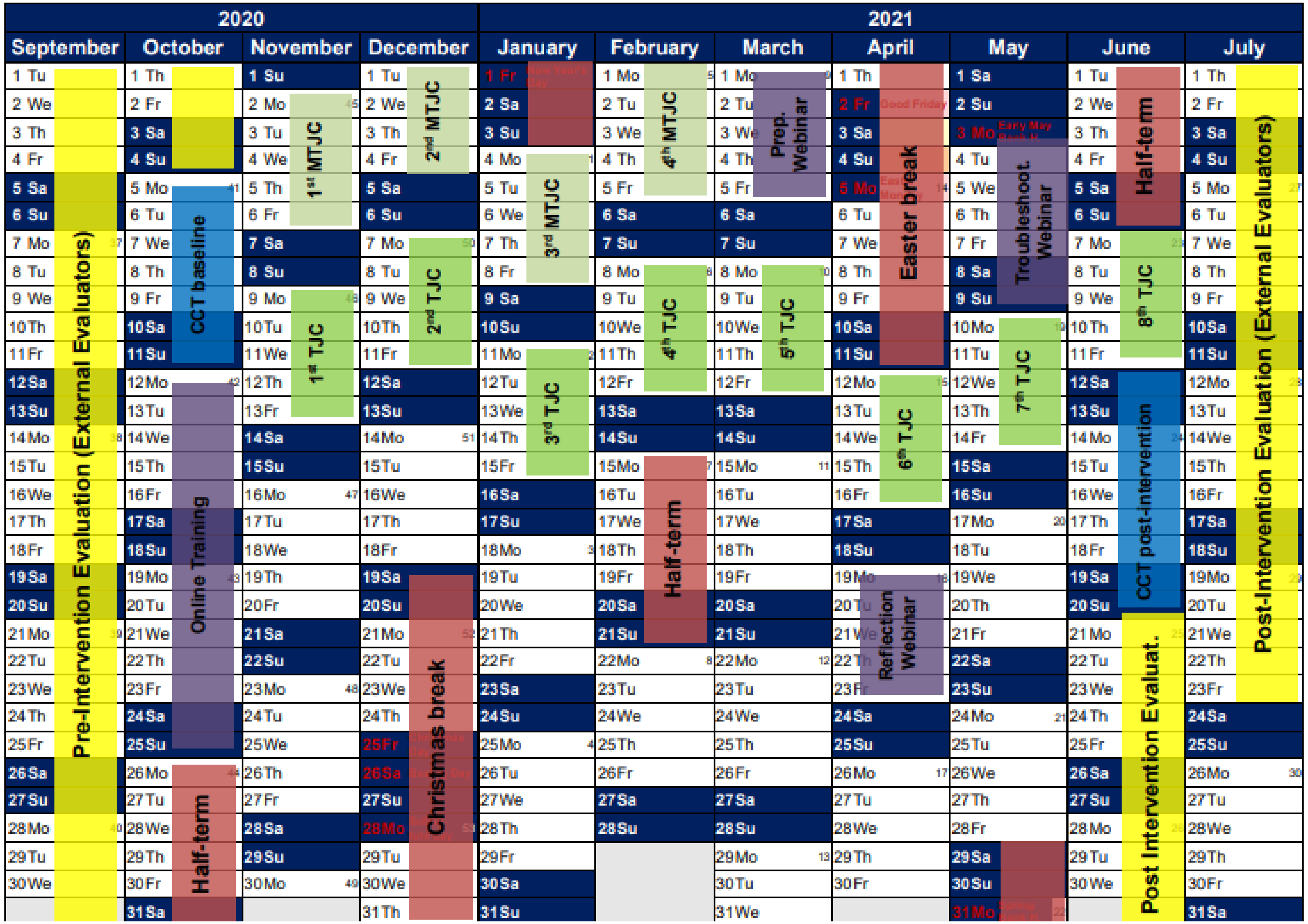
Project aims

- to increase teachers' research appraisal skills
- to increase teachers' use of research in the classroom

Features of the CPD

- Intensive online training at start
- + two follow-up modules

- 8 JC in total
- 4 CJC for facilitators
- Then 2 planning meetings
- Then independent



Features of the CPD

- Groups created according to phase & subject specialism where possible
- 20 groups initially – 12 at the end of the project
- Main dropout from primary
- Dropout mainly COVID-related (where we have feedback)

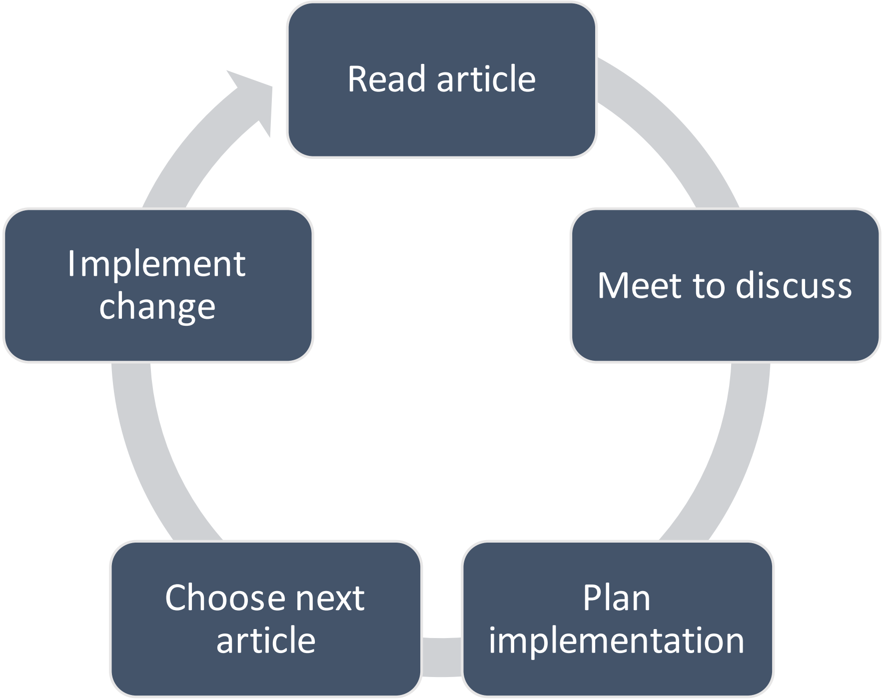
Features of CPD - Online courses

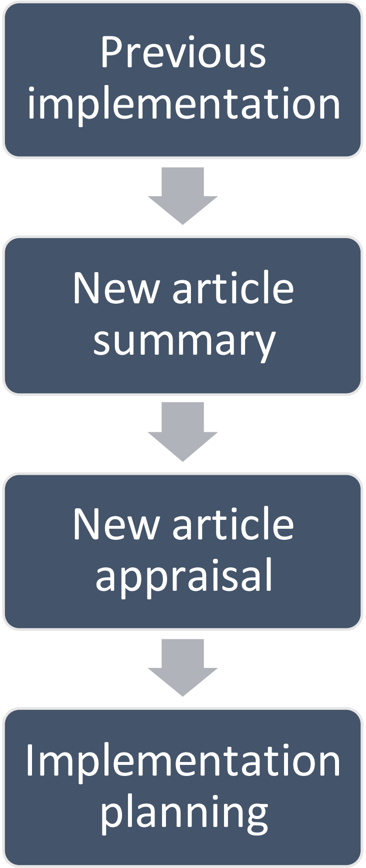
Facilitators	Participants
Practical information & how to use the platform	Practical information & how to use the platform
Research engagement – Self assessment	Research engagement – Self assessment
Course aims and objectives	Course aims and objectives
Journal Clubs • As CPD • In practice • Top tips for new facilitators	Journal Clubs • As CPD
Critical Appraisal of Research • General • Systematic Reviews • Applying Research Findings to the Classroom • *RCTs* • *Qualitative research*	Critical Appraisal of Research • General • Systematic Reviews • Applying Research Findings to the Classroom • *RCTs* • *Qualitative research*

CHARTERED COLLEGE OF TEACHING

Rationale

- “a regular cycle of meetings at which teachers discuss research” (Sims et al., 2017)





Rationale

- Journal clubs are widely used across a range of disciplines, mainly in healthcare, as a form of CPD
- They have been found to improve practitioners' research appraisal skills and their ability to apply findings to practice
- Fulfil a range of criteria that have been described as essential parts of effective CPD
    - Longitudinal
    - Collaborative
    - Evidence-informed
    - Strong link to practice
    - Agency
- Preliminary findings from education suggest that the model could also work in this context (Sims et al., 2017; Greville-Giddings, 2020; Brill et al., 2003; Tallman & Feldman, 2016; Deenadalayan, 2008)

What worked

- Flexibility
- Online meetings
- Accountability to peers
- Cyclical approach
- Subject-specificity
- Cross-phase groups
- High level of guidance in initial phases
- Modelling journal clubs for facilitators & facilitator training
- CAT

RESEARCH-2-PRACTICE

Research-informed science lesson plans for busy teachers

Professor Ian Abrahams: University of Roehampton

Dr Anita Backhouse: University of Lincoln

Rationale for the project

Teachers and trainees are time poor and whilst current guidance might suggest that evidence-informed teaching is the most effective way to enhance teaching and learning, access to, and time to digest, relevant research is a limiting factor.

Aims

To produce a body of resources that addressed ‘tricky to teach’ topics identified by classroom teachers. The resources were to include summaries of relevant pedagogical research together with expert teacher produced lesson plans that applied the recommendations from the research.

The freely available resources and subsequent science lesson planning and delivery would form the basis for the ongoing reflective dialogue between the Initial Teacher Training school-based mentor and primary school or secondary school trainee teacher.

CPD

Initial teacher training (ITT) mentors were trained in instructional coaching approaches to help the trainees make use of and reflect on the lesson plans and associated research.

Lessons learnt

We experienced difficulties in overcoming what we perceived to be professional inertia – changing hearts and minds about an open-minded approach to different suggestions for pedagogical practice.

Avoid the assumption that experienced teachers think there are lessons to be learned from research.

Much more guidance is needed to help mentors and trainee teachers get the most benefit from the resources.

Evidence in Action

Dr Kathryn Atherton, kathryn.atherton@bi.team

THE BEHAVIOURAL INSIGHTS TEAM

Overview

Our pilot project suggests **high-quality, evidence-based default lesson plans** are a promising solution for supporting teachers to engage with and use pedagogical research.

Teachers said:

- The lesson plans helped them engage with research
- The plans changed their practice
- They intended to re-use the lesson plans (outside of the project)

Aim

Problem: Teaching practice is rarely evidence-based

Mission: Support teachers of science to engage with pedagogical research

What makes it a challenge:

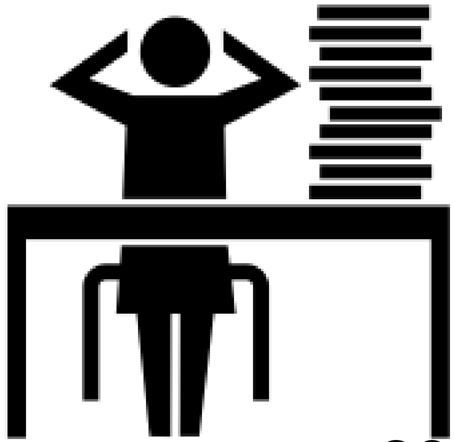
Research engagement is not enough

"most teachers [are] unlikely to be convinced by research evidence on its own: they need to have this backed up by observing impact themselves or hearing trusted colleagues discuss how it had improved their practice and outcomes for young people."

- DfE research on evidence-informed teaching

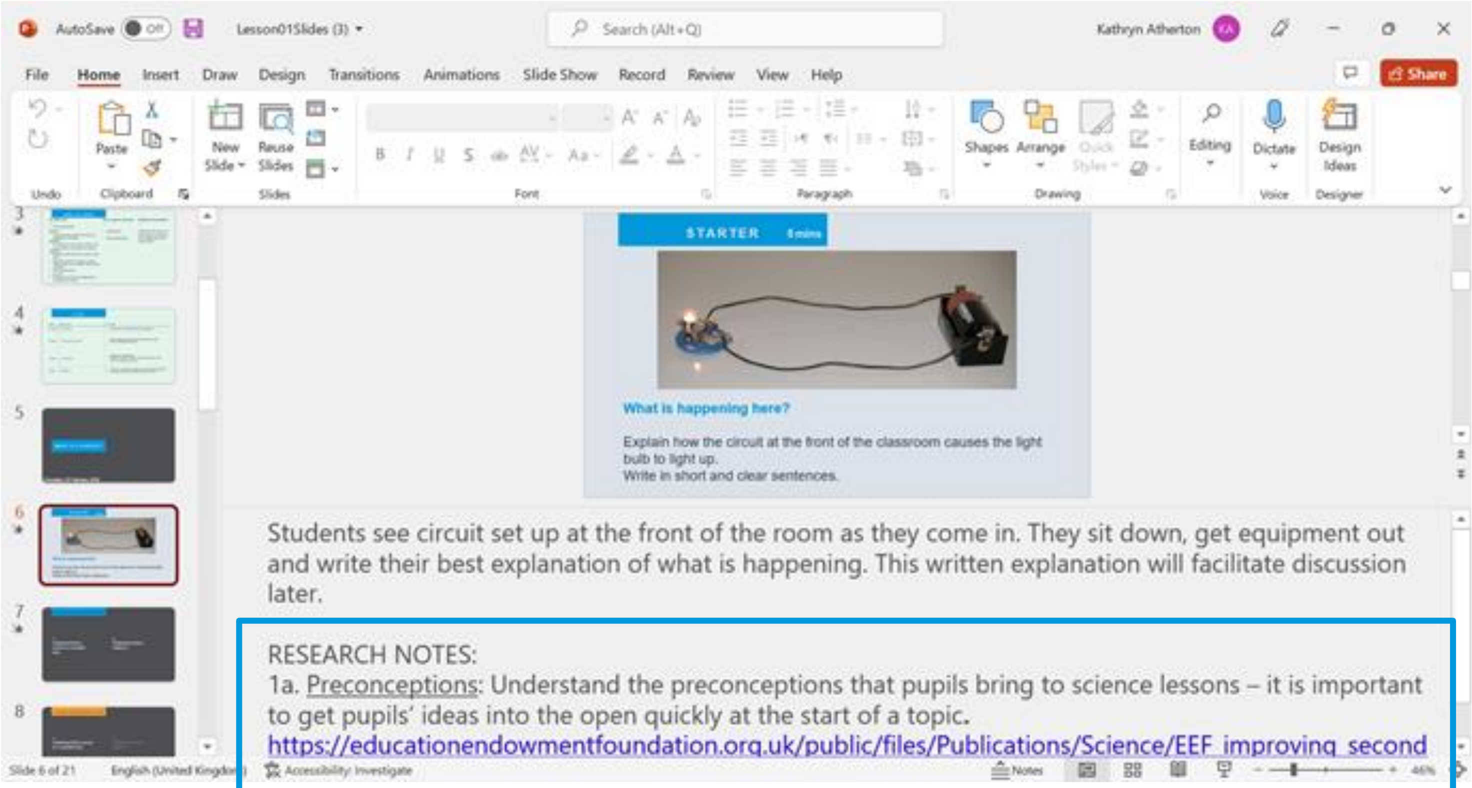
Intention is not enough

Teacher workload



Approach

Provide evidence-based adaptable default lesson plans, with associated training



TIMETABLE & DESCRIPTION OF ACTIVITIES

TIME ACTIVITY RESOURCES	DESCRIPTION	RESEARCH
00:00 – 00:10 Starter Demo equipment: • Large-scale circuit PowerPoint	**Slide 6:** What is happening here? Students see circuit set up at the front of the room as they come in. They sit down, get equipment out and write thei best explanation of what is happening. This written explanation will facilitate discussion later.	1a. Preconceptions: Understand the preconceptions that pupils bring to science lessons – it is important to get pupils' ideas into the open quickly at the start of a topic. Link
00:10 – 00:35 Understand that a circuit is a complete loop Demo equipment: • Large-scale circuit • Rope loop PowerPoint Worksheet	**Slide 9:** Pupils discuss what is happening. Take note of their misconceptions. During the module (e.g. in rope loop model demos) remind the relevant students of what they thought at the beginning and get them to explain how their thinking has changed. **Slide 10:** Rope loop demonstration. Please see the notes below slide 10 for detailed instructions. The teacher represents the battery, passing rope from hand to hand. A student grips the rope lightly to represent a bulb. Based on an IOP activity. See details in the notes beneath the slide (this is an important model for this module: many of the subsequent lessons refer back to it). Discussion of the similarities between the rope loop and the real circuit. Task 1: Identify similarities between rope model and real circuit. Complete sentences explaining how rope loop analogy helps us understand circuits. • Think-pair-share question: How does the rope loop show us that	7a. Feedback: Find out what your pupils understand - It is important that you build up an accurate picture of the current understanding of all your pupils Link 1c. Preconceptions: Allow enough time to challenge misconceptions and change thinking – throughout teaching sequences it is useful to revisit misconceptions. Link 3a. Modelling: Use models to help pupils develop a deeper understanding of scientific concepts – models help pupils to link observations to the sub-microscopic and symbolic levels and to build a richer understanding. Link Misconceptions research on IOP Spark: It is common for students to use the term 'electricity' in an ambiguous fashion that does not differentiate between the concepts of current, potential difference, energy and related terms with precise meaning. Link

Rationale

Make it **easy** for teachers of science to engage with and use pedagogical research.

Changing what happens by ‘default’ is one of the most effective ways of changing behaviour.

The pilot

All year 7 / 8 teachers of physics at 21 schools
(**we recruited 138% of our target sample**, despite the challenging covid-19 context)

8 hours of teaching material (electric circuits)

4 twilight virtual training sessio

- How to use the plans
- Providing feedback

Learnings…

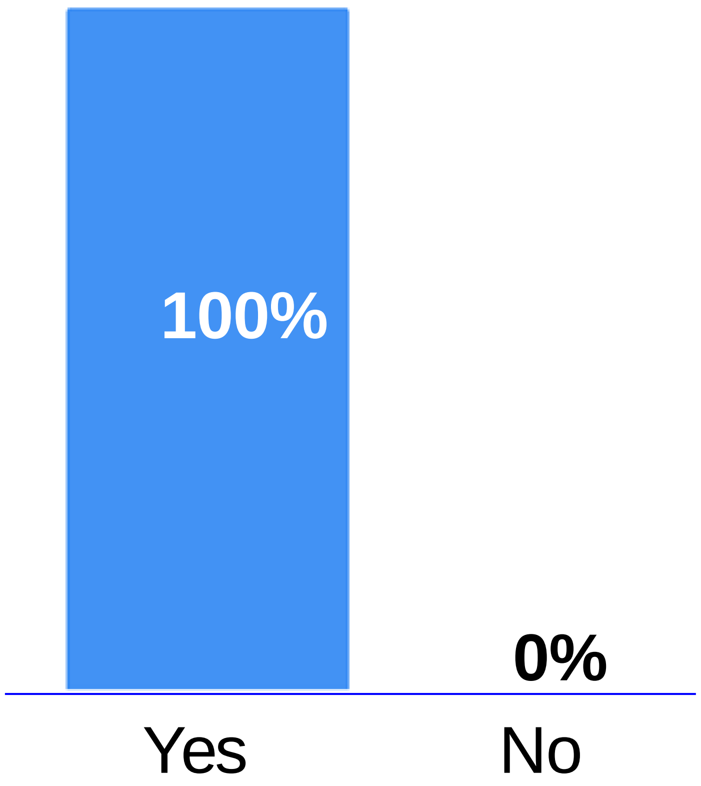
Teachers said that making it easy was critical

*“Even if you have the best intentions, teachers are so busy, so **having these plans allowed teachers to engage in the research when they are usually too busy to do so**.” -Teacher*

*“**If it wasn't right there in front of you, you wouldn't do it.** Now I will make the point of reading the research.” -Teacher*

Good lesson plans will be re-used and therefore have a lasting impact

Would you consider sharing the resources with colleagues and/or using the resources again next year (of your own accord, rather than as part of a project)? (n=46)



“The fact that they are being used now means people will keep coming back to them every year.”
-Teacher

What could come next?

1) **Next step in evaluation** e.g. randomised controlled trial
2) **Support teachers now:** produce similar resources for other subjects and disseminate
3) **Ultimate vision**: a single, comprehensive suite of high-quality, evidence-informed, optional and adaptable lesson plans, freely and readily available to all teachers – across subjects and age-groups.

THE BEHAVIOURAL INSIGHTS TEAM

Get in touch:

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Dr Richard Churches
Education Development Trust

Kate Sims
Education Development Trust

Louise Herbert
STEM Learning

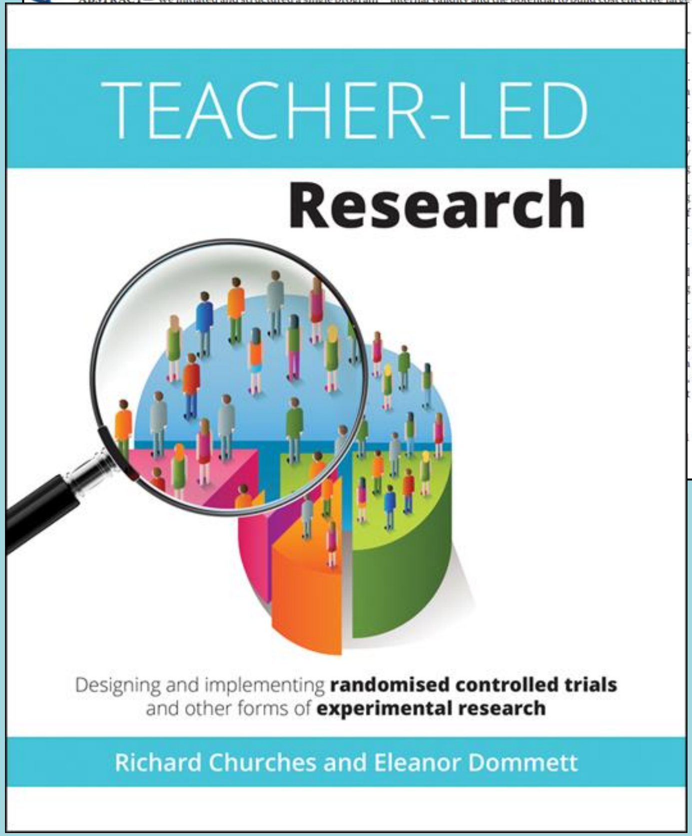
Advancing science pedagogy using scientific method

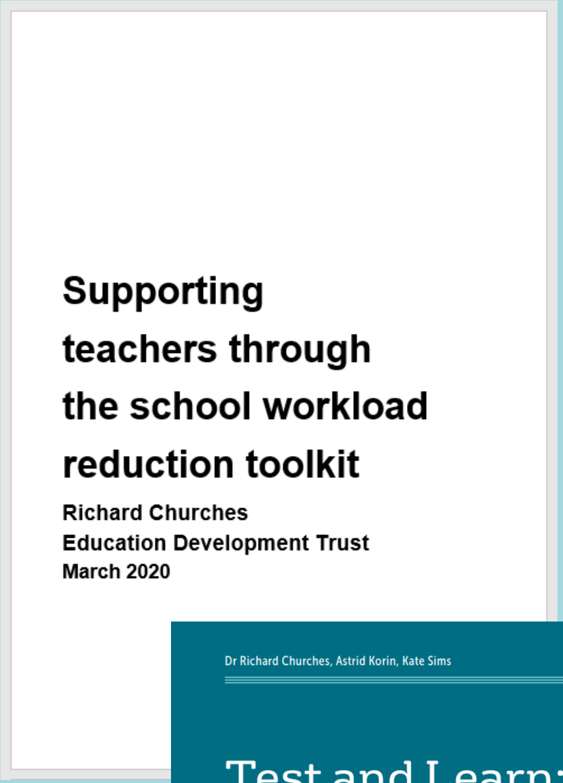
Education Development Trust
STEM LEARNING
wellcome

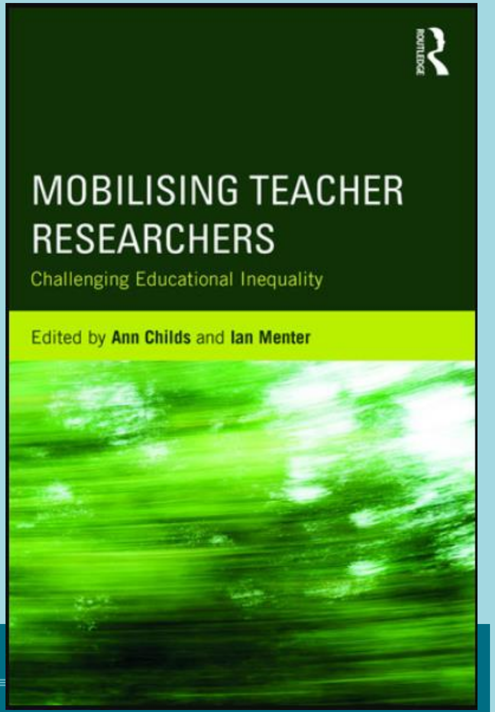
Aims of the project

- Enable science teachers to plan, implement and analyse their own randomised controlled trials and test evidence-based theories/pedagogies introduced on STEM Learning programmes
- Previous projects gave teachers considerable latitude, we focus on a smaller range of related pedagogies with the intention to assess whether this could result in a more valid and reliable final meta-analysis
- Specifically, one with greater heterogeneity – demonstrating the potential of the approach in addition to the range of existing ways to measure education evidence impact and enable evidence mobilisation
- By extension, support STEM Learning in the evaluation of the effectiveness of their own programmes and enable learning from this


MIND, BRAIN, AND EDUCATION
Translating Laboratory Evidence into Classroom Practice with Teacher-Led Randomized Controlled Trials—A Perspective and Meta-Analysis
Richard Churches[1], Eleanor J. Dommett[2], Ian M. Devonshire[3], Robin Hall[4], Steve Higgins[5], and Astrid Korin[1]


TEACHER-LED
Research
Designing and implementing randomised controlled trials and other forms of experimental research
Richard Churches and Eleanor Dommett


Supporting teachers through the school workload reduction toolkit
Richard Churches
Education Development Trust
March 2020


MOBILISING TEACHER RESEARCHERS
Challenging Educational Inequality
Edited by Ann Childs and Ian Menter


Dr Richard Churches, Astrid Korin, Kate Sims
Test and Learn: A global revolution in teacher-led research
Education Development Trust

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The effect of pre-lab tasks on retention and understanding in practical work

Castle Rushen High School

Louise Williams

PURPOSE OF RESEARCH

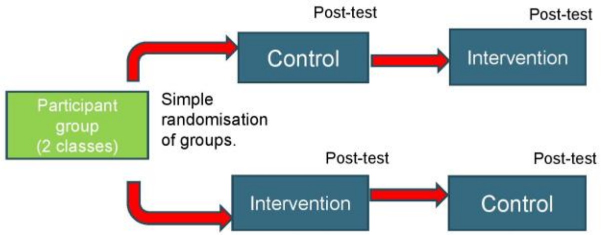
There is evidence that pre-lab tasks increase retention and improve understanding of practical procedures in students in secondary school (Hennah, 2018) and at third level (Haagsman et al, 2021 and Agustian et al, 2017). Practical work for IGCSE science is assessed either by practical exam (paper series 5), or by written exam, Alternative to Practical (paper series 6).

This study aimed to assess the effect on scoring in Alternative to Practical questions when pre-lab tasks are used to familiarize students with equipment and techniques prior to carrying out a practical investigation, compared with the more traditional teaching method of 'I do, you do', with students following instructions from a method sheet.

THE RESEARCH DESIGN

A within-participant design was used with a post-test only. The independent variable 'the effect of pre-lab tasks on retention and understanding in practical work' was operationally defined by creating two counterbalanced conditions :

- IV level 1 – Control: students watched a teacher demonstration of a practical and then carried out the practical while referring to a dual-coded method sheet
- IV level 2 – Intervention: students completed a pre-lab task prior to carrying out the practical investigation while following a method sheet.



LIMITATIONS

Although results suggest a small positive effect size, especially in female students (r = 0.280) this should be interpreted with caution given the small sample size. A larger replication will he necessary.

The trial was interrupted twice due to Covid lockdowns which may have reduced the size of the effect. Time limitations meant that three of the four post-tests were set immediately after half-term breaks.

The original small sample of 41 students was made even smaller by an attrition rate of 34%.

METHODS

Participants, sample size and randomisation

Two classes of Year 10 students in a comprehensive school in a semi-rural area took part in the study. The overall sample size, after accounting for absences, was 27 students. Cluster randomization was used to randomly allocate the groups to the order in which they experienced the conditions.

Procedures

The **control** condition consisted of 'traditional' teaching of preparation of a salt by crystallization. Students first watched a teacher demonstration and verbally answered questions about the process before carrying out the practical themselves with reference to a dual-coded method sheet. The **intervention** condition consisted of pre-laboratory tasks - students watched an instructional video on acid-base titration and answered written questions on the apparatus and techniques. The questions were peer-marked in the lesson allowing for discussion of any misconceptions.

Students carried out the titration over the following two lessons. Both post-tests consisted of IGCSE past paper questions answered in the lessons following the practical activities.

Materials (and apparatus)

A YouTube clip from the RSC. Worksheets of written questions based on the clip. Solutions of acid and base, indicator, glassware for titration, method sheet, assessment questions on acid-base titrations from IGCSE past papers, series 6.

Metal oxide powder, dilute acid, evaporating bowls, glassware, dual-coded method sheets, assessment questions on preparation of salts from past IGCSE papers, series 6

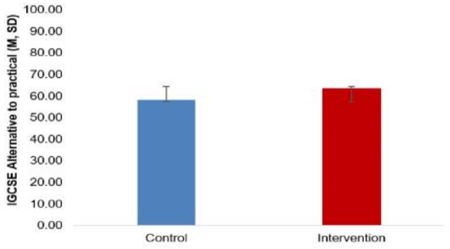
CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

Preliminary evidence suggests that pre-lab tasks may improve attainment for girls with a moderately large effect but without the same effect on boys. This effect on girls' attainment approached significance, although the results should be interpreted with caution because of the small sample size. Further research with a larger sample size will be necessary to confirm the findings. Teacher observation of boys during the trial suggests that they were less likely to engage in the pre-lab tasks compared to girls, and they were also more likely to rush through the practical work. In future replications all students could work in pairs and peer assess each other's practical skills. Alternatively, students could answer 'observation questions' while carrying out the practical.

RESULTS

Pre-lab tasks resulted in higher IGCSE question scores (M = 63.3, SD = 11.4) than normal practice (M = 58.2, SD = 13.9) (Figure 1) and reduced between pupil variation.

Figure 1 – IGCSE Alternative to Practical percentage scores for the control and intervention



A two-tailed Wilcoxon signed-ranks test indicated that pre-lab tasks had a non-significant (p = 0.113) positive effect compared to normal practice (teacher demonstration and method sheet). (r = 0.191, CI (95%) = -0.738 – 1.121) [d = 0.392]. For completeness, results for females and males were also analysed (see Table 1).

Table 1 – Effect Sizes, Confidence Intervals and p-values

	N (n)	Effect size (r)	CI (95%)	p-value	[d]
All pupils	27	0.191	-0.738 – 1.121	0.113	0.392
Females	18	0.280	-0.812 – 1.371	0.064	0.583
Males	9	0.017	-0.862 – 0.895	0.594	0.035

This research was carried out with the support of:

wellcome · STEM LEARNING · Education Development Trust

REFERENCES Hennah, N (2018) A novel practical pedagogy for terminal assessment Chemistry Education Research and Practice, 2019,**20**, 95-106

Haagsman, M.E., Koster, M.C., Boonstra, J. *et al.* (2021) Be Prepared! How Pre-lab Modules Affect Students' Understanding of Gene Mapping. *J Sci Educ Technol* **30**, 461–470

Agustian,H.Y. and Seery M.K. (2017) : Chem. Educ. Res. Pract., 2017, 18, 518

RSC Practical Skills Assessment Video – Titration Procedure (2015) https://www.youtube.com/watch?v=rLc148UCT2w

Does context-based learning improve science understanding?

Gomer Junior School

Alex Merrifield and Georgina Mulhall

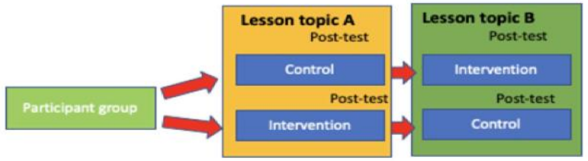
PURPOSE OF RESEARCH

Since the removal of the Key Stage 2 science Standard Assessment Tests (SATs) papers, the science curriculum has lessened its profile in key stage two; in our MAT, we believe that this has impacted on the standards of Lower Key Stage 3 science outcomes. To improve this, we have designed our study to include elements of context and role modelling, to better engage the learner.

Contextualising learning through the use of role models and specialist settings can have significant positive impact on learning; resulting in higher levels of motivation for the learner (Bandura, 1977). With relevant context and relatable content, if appropriately pitched, pupils will be motivated to learn (Harlen, 2011; Curzon, 2013). D. Wilkinson and Stallard (2019) outlines that stimulating pupils' curiosity through the use of contexts and enquiry-based learning, structures independence and collaboration. Additionally, pupils' understanding of the importance of science in future learning and/or careers will be enhanced. Application of the Engineering Habits of Mind (Lucas and Hanson, 2016) pedagogy provides clarity to the skills required of a 21st century learner.

THE RESEARCH DESIGN

A post-test only within a participant design, with a counterbalance, was used. The independent variable was context-based learning,' which was stipulated by the following two variables:
IV Level 1 - Control: practical based learning (regular/common practice)
IV Level 2 - Intervention: Context based learning



LIMITATIONS

The trial was limited by its small sample size and therefore requires replication with greater numbers. Across Year 6, some of the results may have been affected by the wide range of variables; e.g. time of lessons, teacher style, subject knowledge, teachers' enthusiasm and their own science capital to teach the subject matter. Due to the nature of the study, the classes are taught by different teachers; therefore, there may be differences in the delivery of lessons. Thus, this should be taken into consideration when analysing the results of the study.

METHODS

Participants, sample size and randomisation

Two classes of 31, Year 6 children, aged 10-11, at Gomer Junior School took part in the study. There are 36 boys and 26 girls across the 2 classes; these had already been split evenly because the classes are strategically balanced. The pupils were taught in mixed-ability classes and taught by their usual teacher. The pupils learnt in their regular classes in stratified mixed groupings. The within-participant design ordering was randomised.

Procedures

Both classes were taught the same two lessons. The subject content is not part of the KS2 National Curriculum enabling the lessons to be taught as a stand alone (which is complementary to our gSTEM Curriculum). The children are less likely to have prior knowledge and related science capital. Therefore, one class underwent the control lesson, taught inline with our teaching and learning approach. However, any element of context was removed from the lesson. A week later, this class participated in an intervention lesson centred around a different content. The second Year 6 class, experienced the same 2 lessons but in the reverse order. At the end of each learning period, the children completed a post-test of 20 multiple-choice questions to assess their knowledge. The topics were similar, yet had different content to ensure that pupils didn't have existing knowledge proceeding into the counterbalanced lesson.

Materials (and apparatus)

The teachers were provided with: powerpoints, pupil resources and apparatus for both lessons. The select materials were familiar to all and the classroom layout was the same. Teaching Assistants were provided with lesson plans and information to allow them to assist in the teaching of science.

CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

Because of the small group size the results need to be interpreted with caution. However, the results were useful at a school level for understanding how the intervention might be used in the future.

Overall, the pupils enjoyed the context enriched lessons more than normal practice. However, there was a non-significant negative effect on attainment for all pupils in the context included lessons. Sub-group analysis indicated that girls achieved equally in both conditions and enjoyed the intervention lessons more than normal practice, suggesting that for girls, context enriched learning might be a useful alternative treatment. It is important to note, that although boys also enjoyed the intervention lessons more, their attainment was still lower during the context enriched lessons.

In lessons, structured in order that pupils are engaged and focused on developing their science learning and knowledge, in addition to enjoying the learning, teacher observations suggest this is beneficial if we are to ensure boys' learning is equal to girls.

RESULTS

Pupil enjoyment scores (Figure 3) were also compared using the same inferential test. The context enriched lessons were said to be significantly ($p = 0.002$) more enjoyable than normal practice with a moderately large effect size difference ($r = 0.296$, CI (95%) = 0.221 – 0.371) [$d = 0.620$].

Figure 2. Control and intervention scores for all pupils

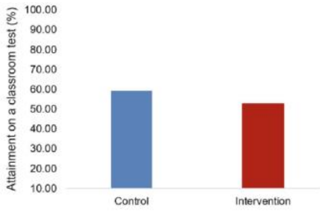
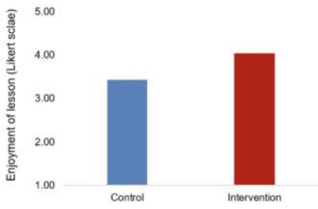


Figure 3. Pupil enjoyment scores



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Subgroups analyses are show below, Table 1 indicating a difference for boys versus girls.

Table 1. Main and subgroup analyses

DV	Group	N/n	r	CI (95%)	p	d
Attainment	All	58	-0.149	-0.851 – 0.553	0.053	-0.302
	Boys	28	-0.210	-0.930 – 0.511	0.084	-0.430
	Girls	30	0.042	-0.872 – 0.789	0.631	0.084
Enjoyment	**All**	**58**	**0.296**	**0.221 – 0.371**	**0.002***	**0.620**
	Boys	**30**	**0.288**	**0.177 – 0.399**	**0.031***	**0.601**
	Girls	**28**	**0.299**	**0.194 – 0.404**	**0.02***	**0.627**

*= $p < 0.05$, **$p < 0.01$

This research was carried out with the support of: wellcome, STEM Learning, Education Development Trust

REFERENCES Bandura, A. (1977). *Social learning theory*. Englewood Cliffs, N.J: Prentice-Hall. Curzon, L., & Tummons, J. (2013). *Teaching in further education*. A&C Black. Harlen, W. (2011). *ASE guide to primary science education*. Hatfield: Association for Science Education. Lucas, B., & Hanson, J. (2016). Thinking Like an Engineer: Using Engineering Habits of Mind and Signature Pedagogies to Redesign Engineering Education. *International Journal Of Engineering Pedagogy (Ijep)*, *6*(2), 4. doi: 10.3991/ijep.v6i2.5366. Wilkinson, D., & Stallard, W. (2019). *Mastery in primary science*. Learning Matters.

What we discovered and achieve

• Teacher recruitment in Autumn 2020.

• Two online remote and distance learning programmes (reading material, video learning content, activities, webinars and templates to support teacher activity). On demand one-to-one support

• Meta-analysis: 21 effect sizes

• Meta-analysis currently shows a significant moderate positive effect across the completed trials ($d = 0.51$, $p < .0005$). Largest effect sizes for the use of simulation(s). Importantly, heterogeneity across completed trials approached 80% ($I^2 = 77.63$)

• Context-based teaching had variable results

Study	Effect size (r)	CI Lower limit	CI Upper limit
Two simulations	0.77	0.54	0.99
Two simulations	0.59	0.37	0.81
Two simulations	0.51	0.22	0.80
Simulation	0.39	0.03	0.74
Context-based learning	0.30	0.19	0.41
Context-based learning	0.30	0.22	0.37
Context-based learning	0.29	0.17	0.40
Pre-lab tasks	0.28	-0.85	1.41
Simulation	0.26	0.02	0.51
Do now starter activity	0.25	-0.14	0.64
Simulation	0.20	-0.16	0.55
Pre-lab tasks	0.19	-0.76	1.14
Do now starter activity	0.18	-0.18	0.54
Do now starter activity	0.12	0.00	0.25
Context-based learning	0.04	-0.82	0.91
Do now starter activity	0.04	-0.39	0.47
Pre-lab tasks	0.02	-0.93	0.96
Writing to learn	0.01	-0.14	0.16
Do now starter activity	-0.11	-0.47	0.24
Context-based learning	-0.15	-0.30	0.00
Context-based learning	-0.21	-0.96	0.54

Implications of the work

- Previously we illustrated the potential of collaborative teacher-led randomised controlled trials to explore the translation of neuroscience findings into classroom practice (Churches et al., 2020), develop teacher evidence-based practice (Churches, Hall and Higgins, 2018) and explore workload reduction (Churches, 2020)

- These results illustrate the potential of collaborations to inform education policy and school-level decision-making

- Drawing on the notion of 'citizen science' (Gura, 2013), it supports the potential of commissioning large groups of teachers to conduct teacher-led research with a view to using meta-analysis of the findings to inform and adapt policy

In conclusion

- Ending up with any completed teacher research during the Coronavirus health emergency was a major achievement – extremely grateful to those teachers who persevered, despite the huge challenges
- Recruitment was very difficult. We had to change all of our original plans and materials to implement an entirely remote and distance learning programme
- We hoped to add more effect sizes to the analysis, however, have been mindful of the huge pressures on schools (post-Covid)

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Research findings and implications

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Research aims

Extend the knowledge base on:

- **how science teachers go about using and/or carrying out** pedagogical research,
- how they can be **effectively supported** to do so
- the **impacts** of their use of research/doing research

Mixed-methods research design

Baseline and endpoint surveys

Longitudinal project team and participant interviews

Endpoint participant interviews and focus groups

Observations of project sessions

Analysis of recruitment and retention data

Programme outcomes

Outcomes methodology

- Baseline and endpoint surveys were used to measure any changes the programme might have contributed to.
- Factor analysis was conducted and the factors that emerged all had good reliability. These formed our outcome measures.

Research engagement and use measures

- adapted from NFER's Research Engagement Measurement Survey (Nelson et al., 2017)

Science pedagogy measures

- derived from the EEF's Improving Secondary Science Guidance Report (Holman and Yeomans, 2018)

Limitations

- Findings rely on self-report data
- Drop-out rates from the projects were high
- Matched sample size was relatively small (n=198)
- A single study – evidence needed from multiple studies

The absence of a counterfactual means that causal claims cannot be made.

Research engagement and use outcomes

Measure The teacher …	Effect sizes (Cohen's d)
is confident in accessing research evidence	0.516 (large)
is confident in assessing the quality of research evidence	0.500 (moderate/large)
is confident using and applying research evidence	0.542 (large)
actively uses research evidence in practice	0.328 (moderate)

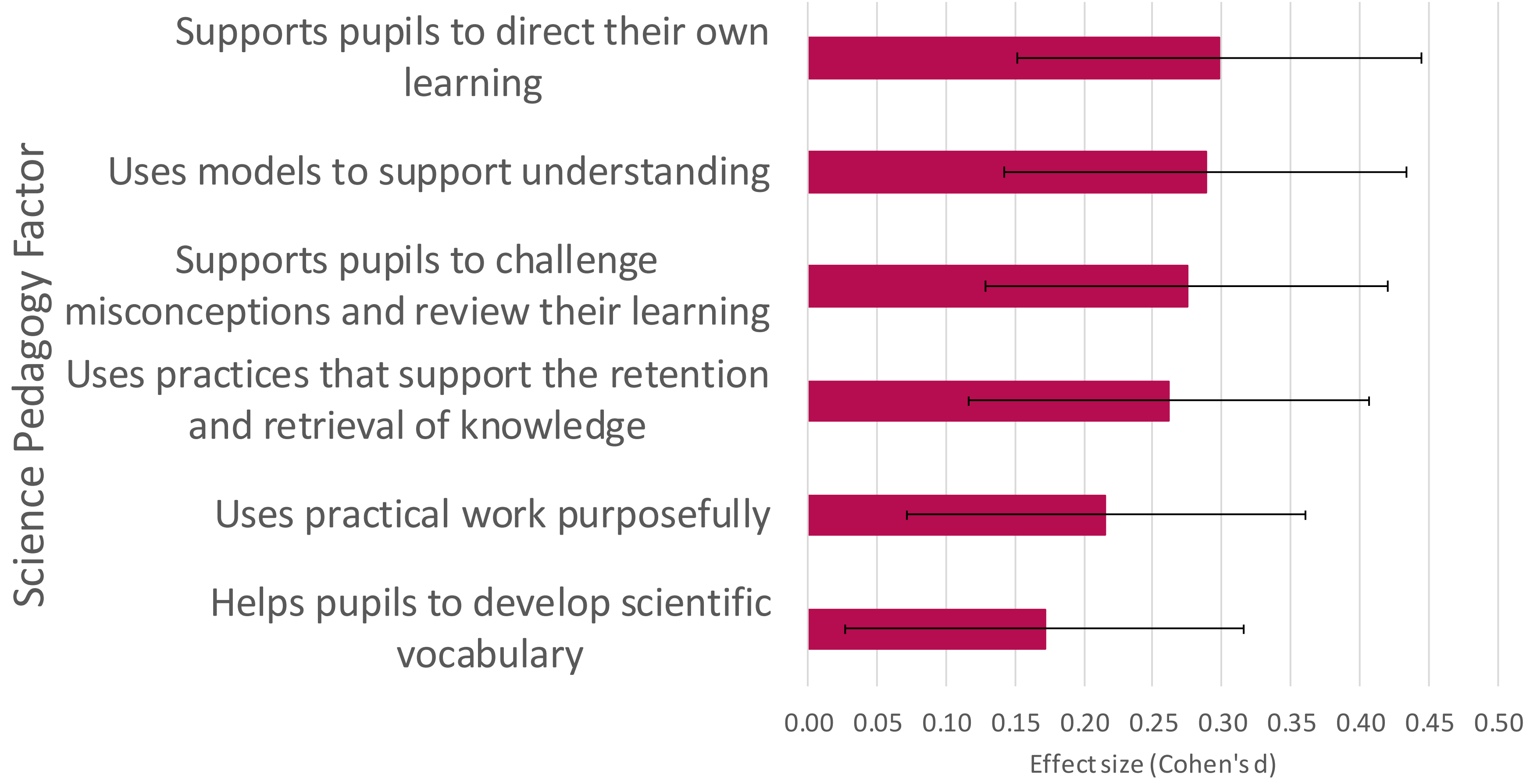
"I think my confidence with reading research papers and evaluating them has increased… I now know things I should be looking out for in terms of what makes good research compared to poorer research."

(Teacher, Journal Clubs)

"It's given me a better way of accessing research – having websites and the links provided that are already vetted and looked at in terms of how much it's going to support your teaching."

(Teacher, Evidence in Action)

Science Pedagogy Outcomes



An understanding of cognitive theory, retrieval practice, spacing, metacognition, has all come to the forefront of my practice

(Teacher, Journal Clubs)

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Other outcomes

- There was some qualitative evidence to indicate that project participation had enhanced research engagement and use in interviewees' departments and/or teams

- This outcome was strongest in the project that had recruited whole departments or teams

Teachers' use of research

Accessing and engaging with research	Transforming research for practice

Using, doing and brokering research in school

and how it can effectively be supported

Accessing and engaging with research

- Most participants only accessed research sources provided by their project

- Project leader decisions on pedagogic focus, format and type of research were highly influential on teachers' subsequent engagement and with and use of research

Accessing and engaging with research

Research summaries and research-informed resources were welcomed for ease of access to 'vetted' and relevant research

'It's given me a better way of accessing... research. ... it is already vetted [and] checked, it's looked at in terms of how much they think it's going to support your teaching ….I know I'm going to find something useful as opposed to ... thinking, well I might find something useful after a couple of hours, but it's a couple of hours that I don't have.'

(Teacher, Evidence in Action)

Accessing and engaging with research

Engagement with journal articles appeared to include a deeper consideration of the research:

> ‘[in a couple of papers] *we weren’t sure about the sample size.* [In] *Another one... we were not convinced that the selection of* [students] *would be mirrored in the school environments that we were in... Therefore we weren’t too sure.. if we .. tried to apply that to our setting, whether it would work or not.’*
>
> (Teacher 5, Journal Clubs)

While depth of engagement did not appear to impact on research-use in this study there may be differential effects in the longer-term.

Engaging with and transforming research for practice

Engagement and transformation of research were

- non-linear, iterative and highly interrelated processes
- triggered by perceived relevance
- shaped by the participant's school context
- often social processes –involving discussion with project and school colleagues

Engagement and transformation were effectively supported by :

- structured discussions and questioning
- use of critical appraisal and implementation tools

Illustrative quotes

The value of project discussion in engaging with and transforming research

there have been a few of those, .. light-bulb moments where we've been able to really pick apart -this is what it says, how is it relevant and how can I try to experiment with this in my own classroom…. So that's been really, really helpful for me to see how other people have done it and, and to get their ideas.

(Focus Group, Journal Clubs)

The role of context in shaping engagement and transformation:

What I found really interesting was that the other person that came to most of the groups, her setting was very, very, different and so the way that she was interpreting and using a lot of it was very different to the way that I would and the things that we were going to trial were very different.

(Focus Group, Journal Clubs)

Transforming research-informed resources

- Participants were encouraged to and did make ***significant*** adaptions to provided research –informed resources

  'We have particular ways that we structure our lessons... any resource was... modified to fit that structure for our school and our students... there was a slight tweaking of the ordering of the sequence... we tweaked [the assessment] *quite a bit... tweaked the resources to suit... the way that we teach science.'*

  (Teacher 10, Evidence in Action)

- Whether the adaptations might compromise fidelity to the research and lead to less effective practices did not appear to have been considered.

Using research in school

- In-school research use was predominately' instrumental' in intent and was integrally bound with 'conceptual use'
- Research was sometimes used 'strategically' to drive forward pedagogical change
- Research-informed approaches and resources were implemented through a 'plan, do, review' cycles

Using research in school

- Projects support for implementation reported as effective by participants included:
  - discussing plans and implementation experiences in workshops and clubs
  - implementation planning tasks and tools
  - mentoring

… I just said [to the trainee teachers] choose whichever [of the provided lesson plans] you want ..afterwards we evaluated the lessons, talked about …what they thought of.. and how it [would] help them when they are ready to start teaching in September.

(Mentor FG2, Research to Practice)

Teachers brokering research

Participants brokered research use in school by:

- sharing research sources and research-informed resources
- leading collaborative discussions focused on transforming research ideas, adapting research-informed resources, and planning implementation.

'I've been looking at how to embed some research into [the year 9 curriculum]… thinking about the cognitive load aspect. the sequencing, the effective use of practicals. So[I'm] facilitating a collaborative approach towards that planning and the sequencing of lessons

Teacher 8, Journal Clubs

Using, conducting and brokering research

Research use/conduct and brokerage were enhanced in schools that:

- had a culture of collaboration and engaged in collaborative lesson and curriculum planning
- encouraged teachers to experiment with their practices

Learning about effective research brokerage by CPD providers

Teachers can best be supported by providing an integrated CPD package, including high-quality training, resources and one-to-one support, that:

- is tailored to their career stage, phase, role, interests and available time
- scaffolds research engagement, transformation and use
- is compatible with the National Curriculum and the pattern of the academic year
- includes regular, easily accessible and flexible training/meetings and support and discussions with peers

the regularity of the meetings .. you knew that there'd be an article at this point and it kind of just became part of the normal way of life during term time. (Teacher, Journal Clubs)

Learning about effective research-informed resources

Resources reported to be most useful were:

- an easy-to-adapt set of lesson plans for a sequence of lessons for a difficult to teach topic
- accompanied by a set of teaching and learning resources
- linked to the national curriculum
- linked to research evidence
- integrates topic, subject specific and generic pedagogical research

Research findings
Q&A

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