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A randomised controlled trial of spaced learning in a primary school context

Study A: KS1 parallel replication (geography)



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PURPOSE OF THE RESEARCH

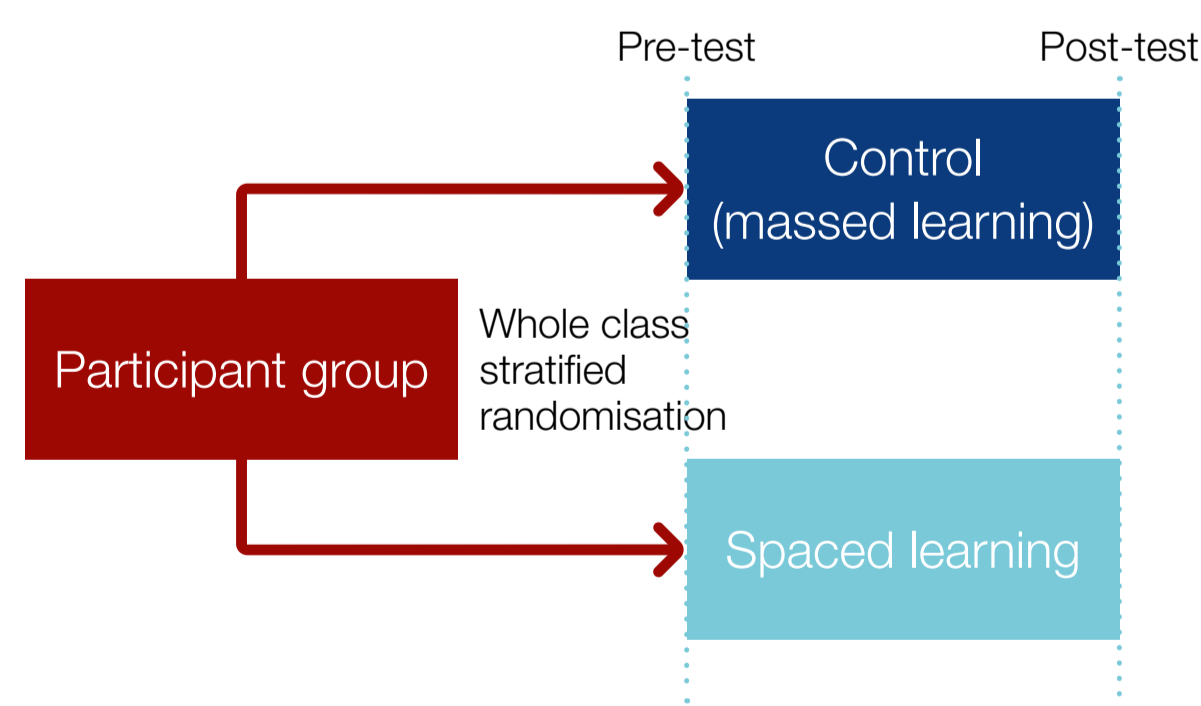
This poster presents one of two parallel replications that have sought to explore the effect of spaced learning in a primary school context. This research (Study A) looked at spaced learning in KS1 geography lessons. The parallel study (Study B) explored the effects of using spaced learning in KS2 history lessons. As Dommert, Devonshire and Churches point out, for evidence from the science of learning to be translated effectively into classroom practice, there will need to be 'wide replication to control for individual pupil differences as well as school context' (2018: 64). There is evidence that spaced learning has an impact on GCSE science outcomes with Year 9 and Year 10 pupils when contrasted with a 'massed learning' approach (i.e. without spacing) (O'Hare, 2017), as well as evidence for its potential to make long-term memories in minutes (Kellaway, 2010; Kelley and Watson, 2013). The study conducted by EEF (O'Hare et al., 2017) at Hallam Teaching School Alliance, focused on both 10-minute spaces (supported by neuroscience literature) and 24-hour spaces (supported by cognitive psychology literature). The two parallel replications (Study A and Study B) sought to evaluate the use of the shorter 10-minute spaces with younger primary-aged children from Year 1 to Year 6.

THE RESEARCH DESIGN

A between-participant design was used with a pre-test and a post-test (Figure 1). The independent variable (spaced learning) was defined operationally by creating two conditions:

- IV level 1 (Control) – Massed learning, normal classroom practice
- IV level 2 (Intervention) – Spaced learning (10-minute spaces)

Figure 1. Research design



Dependent variables:

- DV1 – percentage score on a 10-question test
- DV2 – Likert scale enjoyment assessment at the end of the lesson

LIMITATIONS

The small sample size in this study, with an attrition rate of 2.5%, means that the findings must be interpreted with caution. In addition to this, the research design required that different teachers carried out each experiment which, while conserving ecological validity, potentially caused variation in delivery for each randomised controlled trial.

METHODS

Participants, sample size and randomisation

Participants were all pupils of St John's CE Primary School. There were 120 participants in total: 60 in Year 1 and 60 in Year 2. The existing classes were already stratified for equal numbers of boys, girls, abilities, SEND and autumn-, spring- and summer-born. These whole classes were randomly allocated to the control or the intervention (one for each year group).

Procedures

All classes were taught one geography lesson on the Weather and Physical Features of the Arctic. This subject was chosen because it is not part of the current curriculum and so could be taught as a stand-alone lesson. The participants were taught by their usual teacher and the lesson took place in their own classroom. The control class was taught through a traditional massed learning method, while the intervention group was taught using spaced learning.

The content of parallel lessons was the same, but in the spaced learning condition it was repeated and presented in different ways at a greater speed. Both lessons took one hour in total. The control group lesson was in three sections: input, related activity and plenary, without any breaks. The experimental group was taught in the following sections: 10 minutes teaching, 10 minutes distraction, 15 minutes teaching, 10 minutes distraction, 15 minutes teaching. Distractions included meditation, singing and dancing; these were chosen by the teacher.

Materials (and apparatus)

Teachers were supplied with lessons plans, PowerPoints and worksheets for all lessons. Teachers were also supplied with a 10-question pre-test and post-test question sheet for the children (based on the lesson content) and an answer sheet for the TA to mark from. The classroom layout was as normal in all lessons.

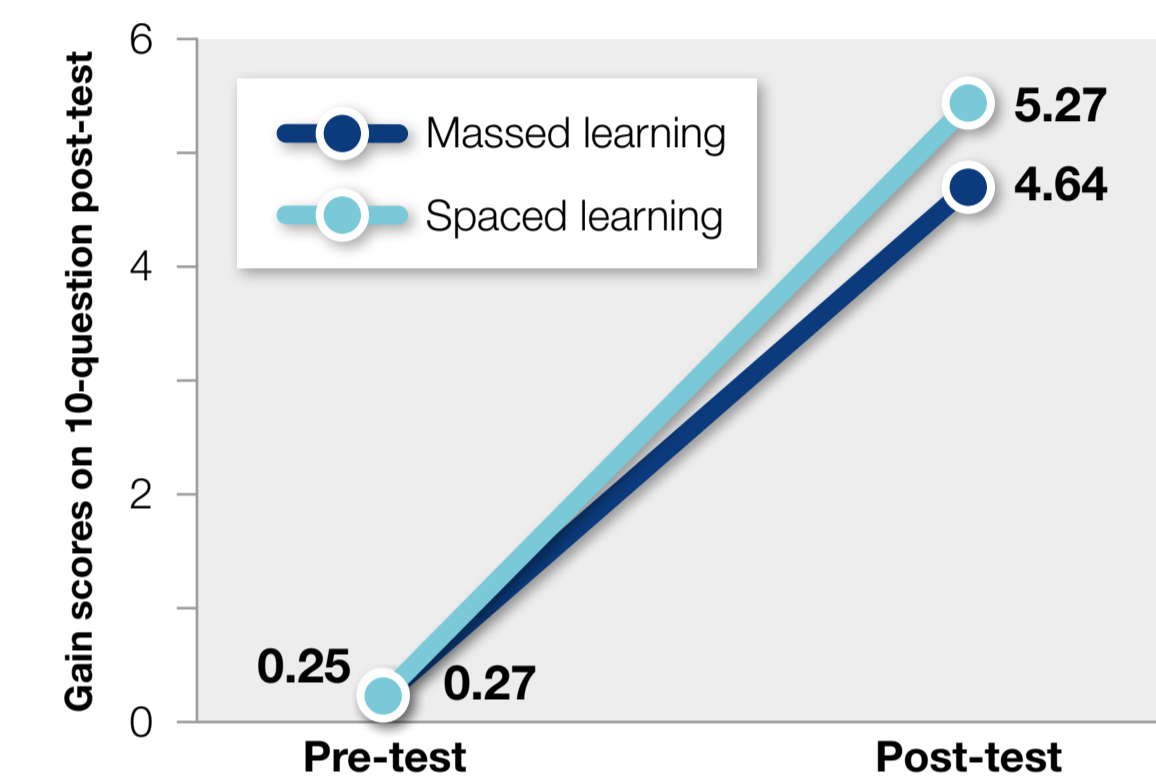
CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

Spaced learning in KS1 has a small non-significant impact on learning. While this study focused on the acquisition of subject knowledge, future research could potentially focus on more practical skills such those needed in computing. For example, KS1 children could benefit from spaced learning of skills such as switching on, logging or coding, as the quick repetitions with spaces between could potentially enable children to encode these skills into long-term memory. Whereas the effect in the parallel replication (Study B) was significant for all KS2 pupils, the overall effect in the present study (Study A) only approached significance.

RESULTS

Pre- and post-test results for massed and spaced learning in the KS1 geography lessons can be found in Figure 2.

Figure 1: Pre- and post-test scores for massed and spaced learning in KS1 (all pupils, N =117)



Preliminary assumption testing showed that analysis across all pupils' results, and for Years 1 and 2, could be carried out using Quade's F with pre-test scores as the covariate (a form of non-parametric ANCOVA) (Table 1)[†]. All effects were positive and ranged from small to moderately small.

Table 1. Non-parametric ANCOVA results and effect sizes (np2 with Cohen's d equivalent)

	N/n	Effect size (np2)	[Cohen's d]	p-value	CI (90%)*
All pupils	117	0.019	[0.29]	.066	0 – 0.08
Year 1	57	0.0004	[0.04]	.443	0 – 0.07
Year 2	60	0.04	[0.43]	.065	0 – 0.15

Pupils were asked to rate how much they enjoyed each of the different approaches on a 7-point Likert scale. A two-tailed Mann-Whitney U test indicated a very small ($r = 0.05$, CI (95%) = -0.13 to 0.23) non-significant ($p = .882$) preference for spaced learning compared to massed learning.

[†] test identification and analysis were carried out using StatsWizard[®].

* because the effect size partial eta squared (np2) cannot be a negative number the convention is to report the 90% confidence interval with 0 as the lower bound.

This research was carried out with funding and support from:

