



Frances Bryant-Khachy

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

Study B: KS2 parallel replication (history)



St John's CE Primary School, Buckhurst Hill, Essex
West Essex Teaching School Alliance
f.khachy@st-johns-buckhursthill.essex.sch.uk
www.st-johns-school.com

PURPOSE OF THE RESEARCH

The study presented below is one of two parallel replications that aimed to explore the effect of spaced learning in a primary school context. This research (Study B) evaluated spaced learning in KS2 history lessons. The parallel study (Study A) explored the effects of using spaced learning in KS1 geography lessons.

Replication is an essential component of scientific method (Churches and Dommett, 2016) and one likely to be of crucial importance in translating evidence from the laboratory to the classroom (Churches, Dommett and Devonshire, 2017; Dommett, Devonshire and Churches, 2018). By replicating the same protocol with children of different ages in different subject areas it was hoped to begin the development of a more nuanced discussion about when, where and with whom to apply spaced learning. See Study A for a longer discussion of the prior research supporting the particular spaced learning approach that was chosen.

THE RESEARCH DESIGN

A between-participant design was used with a pre-test and a post-test (see Study A, 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)

Dependent variable:

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

LIMITATIONS

The sample size, with an attrition rate of 4.5%, was relatively small, so should 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 224 participants in total: 50 in Year 6, 56 in Year 5, 56 in Year 4 and 52 in Year 3. 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 history lesson, as below (Table 1).

Table 1. History topics by year group

Year	Topic
3	History (The Life and Achievements of Amelia Earhart)
4	History (The Life and Achievements of Amelia Earhart)
5	History (Alfred Nobel's Legacy of the Nobel Prize)
6	History (Alfred Nobel's Legacy of the Nobel Prize)

These history subjects were chosen as they are not part of the current curriculum so could be taught as stand-alone lessons. The participants were taught by their usual teacher and the lessons 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.

RESULTS

Pre- and post-test results for massed and spaced learning in the KS2 history lessons can be found in Figure 1.

Preliminary assumption testing showed that analysis of Year 5 results could be carried out using Quade's F with pre-test scores as the covariate (a form of non-parametric ANOVA) (Table 2). However, results for all pupils and Years 3, 4 and 6 did not meet the assumption that the covariates were distributed in a similar way across both groups; therefore these analyses reverted to the use of gain scores calculated from pre- and post-test scores (Table 3)[†].

Figure 1. Pre- and post-test scores for massed and spaced learning in KS2 (all pupils, N =206)

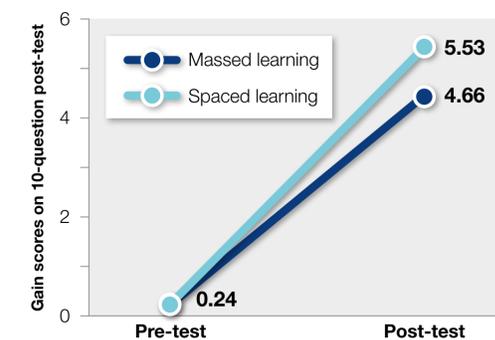


Table 2. Non-parametric ANCOVA results and effect sizes (np2 and Cohen's d equivalent)

	n	Effect size (np2)	[Cohen's d]	p-value	CI (90%)*
Year 5	54	0.15	[0.84]	.002	0 – 0.29

Table 3. Gain score Mann-Whitney U test results and effect sizes (r and Cohen's d equivalent)

	N/n	Effect size (r)	[Cohen's d]	p-value	CI (95%)
All pupils	206	0.17	[0.34]	.008	0.03 – 0.29
Year 3	50	0.06	[0.12]	.065	0 – 0.15
Year 4	56	0.29	[0.45]	.053	-0.05 – 0.45
Year 6	46	0.14	[0.28]	.171	-0.16 – 0.41

The KS2 pupils were also 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 small ($r = 0.14$, CI (95%) = 0.004 to 0.27 significant ($p = .009$) preference for massed learning compared to spaced 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.

CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

Spaced learning appears to have a small to moderate impact on children's progress in history, validating its use as a method of teaching. From individual year group results, it appears that spaced learning has more potential for older children. Future research could focus on Years 4, 5 and 6. In particular, it could be useful for schools to investigate spaced learning in relation to SATs revision, or SPaG lessons, as the structure of the lessons has the potential not just to increase children's progress, but also to reduce fatigue and increase enjoyment.

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