National College for Teaching & Leadership

Closing the gap: test and learn

Teacher led randomised controlled trials - Numeracy

January 2016

Contents

1 What is the early adopter strand of closing the gap: test and learn?

The delivery of comprehensive training for teaching schools participating in the closing the gap: test and learn programme covered rigorous and robust research methods appropriate for use in schools, including quantitative research methods such as RCTs, so that teachers gained an awareness of research methodologies (set-up, design and evaluation) and were able to contribute effectively to the trials. This also ensured that teachers in different contexts were able to deliver the interventions under trial in a consistent manner. The strand of work delivered through the RDNE events focused on training teachers in the delivery of small-scale RCTs (and other forms of experimental research) and immediately yielded school-level activity. In response to this, the NCTL made available 50 ‘early adopter’ grants to support participating teaching schools and their alliances in delivering their own small-scale RCTs. A total of 48 of these studies were presented at a conference poster event at NCTL in Nottingham on 21 October 2015.

2 Research posters

This supplementary document to the main closing the gap: test and learn report contains examples of small-scale trials (micro-enquiries) that were designed and run by teachers, with support from the project team. The teachers running each trial produced a research poster to display at the dissemination event in October 2015, similar to the way that postgraduate researchers present their work at conferences.

50 schools were funded to carry out micro-enquiries as part of closing the gap: test and learn. 47 posters were produced in all. 2 studies were not completed as a result of factors outside the control of the teachers. 1 further study was completed but the school did not produce a research poster in the correct format.

The posters contained in this document all relate to interventions aimed at improving pupils' numeracy.

WEST ESSEX TEACHING SCHOOL ALLIANCE

Using the visualisation technique of bar modelling does not improve the choosing of an appropriate method to solve word problems in mathematics

Angela Cass

St John's CofE Primary School, Buckhurst Hill

West Essex Teaching Schools Alliance

Introduction

The use of labelled bars to provide a written visual method of representing numbers and number operations is a key element of the teaching of mathematics in Singapore, a country that consistently scores well in international rankings.

The most common approach in the teaching of mathematical problem solving in the UK in KS2 is the use of a structured approach, known by the mnemonic RUCSAC (Read the problem, Understand the problem, Choose a calculation, Solve the calculation, Answer the question, Check the calculation). The sticking point for many children is U – understanding the problem.

The use of bar models may enable children to understand the context of the problem more clearly, and help them to identify the key numerical information and the required calculations.

Many children have high anxiety when faced with a word problem. This maths anxiety can be just as debilitating as learning difficulties such as dyslexia, dyscalculia and memory processing issues. The interwoven literacy and numeracy demands of word problems often prove overwhelming. Bar modelling could offer a visual prompt to give access to the problem, thus reducing anxiety.

Research Design

A between-subject design was used with a pre- and post-test. To address the aims of the research, the independent variable of using a bar model to represent the problem was operationalised by creating 2 conditions:

IV Level 1 (Control condition): Normal practice of the RUCSAC approach to solving word problems in mathematics with discussion and, where present, the children's own visual models to represent the problem.

IV Level 2 (Intervention): The RUCSAC approach with discussion and bar models used to visually represent the problem.

Method

Participants

Two parallel year 5 classes of 23 children each. Children had been assigned to the classes at the beginning of year 3 to achieve a balance of gender, ethnicities, SEND, EAL, birth months and attainment within each class. The allocation of the classes to control and intervention groups was random.

Procedure

Eight hour-long maths lessons were taught on consecutive days. Both groups were taught by the researcher to remove teacher variation. The first four lessons concentrated on multi-step problems (a familiar type of problem); the second four lessons concentrated on equal and unequal sharing problems (a type of problem that is often difficult to understand).

Each lesson used discussion about the problems as a focus, both as a whole class with children coming to the IWB to demonstrate their thinking and through paired collaborative work. Children who preferred to work alone were allowed to make that choice but had to explain their thinking to others at a later point. The children were given only a few problems and were required to concentrate on the method rather than the solution.

The control group were shown the bar-modelling technique at a whole class level and in pairs, working with the teacher or the TA. The control group were allowed to use alternative visual models to explain their thinking. Otherwise, the two groups received identical lessons.

Feedback to the children was based on their effort and persistence, their willingness to celebrate mistakes as learning opportunities and their open -mindedness to evaluate different methods. Feedback was never based solely on correct solutions. No marks were given to the children.

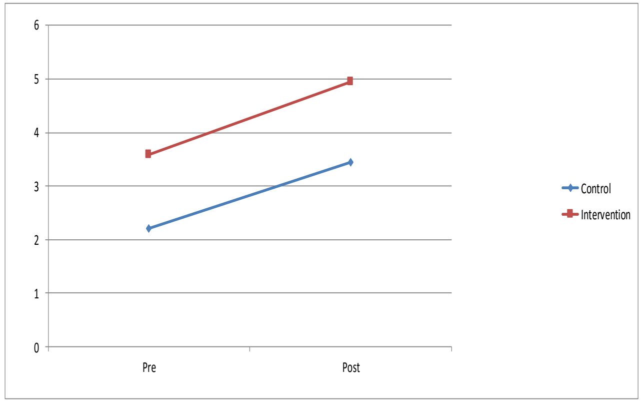
Materials

The lessons were designed by the researcher and used contexts from the children's lives e.g. a charity cake sale that some of them were organising.

A pre and post test was used, each with 8 similar questions based on problems from the children's previous and current text books (Collins Maths Framework 5A and 5B).

Results

Using gain scores, an independent sample t-test indicated that the intervention group's progress (mean difference=1.25 SD=1.12) was not significantly greater or lower (p=0.917 two-tailed, d=0.032) than the control group's progress (mean difference=1.29 SD=1.06).



Conclusions

This research suggests that using bar-modelling as a visualisation technique to improve the choosing of an appropriate method when solving word problems in mathematics is as effective as using existing best practice.

Ethical considerations about the control group getting the best teaching possible, meant that they used alternative visual modelling. As such, the control group got models that the intervention group didn't get, introducing another variable. In conclusion, using bar-modelling to improve problem-solving is an alternative treatment to existing practice.

Some children already had some very entrenched ideas about problem solving and were resistant to a new methodology. It would be useful to trial bar-modelling with younger children who are moving from concrete to pictorial concept development.

The ASPIRER Teaching Alliance

Preliminary evidence from a small scale pilot study into the effectiveness of playing games as a means of developing fluency in the automatic recall of times tables

Lead Researcher: Megan Dixon
Schools involved: Schools within the Aspirer Teaching Alliance, Cheshire

Introduction

"*Rote learning is one thing, but integrating pieces of information is another. If these pieces are disparate, as may be the case with rote learning, then retrieval is hard. Rote learning is clearly useful for learning technical terms. But what about recalling the right word at the right time? Effective learning is more than just cramming one's head full of information. We must also develop our ability to retrieve the information that is useful for a specific situation. Information storage is plentiful and cheap but access and retrieval are often hard.*" (Blackmore and Frith, 2005)

Ofsted (2011) noted that "*a good recall of number facts such as multiplication tables and number bonds are considered… to be essential precursors for learning traditional vertical algorithms (methods) for addition, subtraction, multiplication and division*" (p6)

With the introduction of the new National Curriculum (2014) comes with enhanced expectations of attainment in both Numeracy and Literacy. Teachers across the Aspirer Teaching School Alliance identified the area of calculation as a strand to be developed and recognised that the automatic recall of the multiplication facts remains a challenge for many children. It appears that the children appear to know the facts when they are tested in isolation, but seem to lack the speed and automaticity of recall to be able to use their knowledge effectively during more complex calculations. On Teachers felt they lacked clarity about the most effective approaches to support the children to develop fast automatic recall of these essential facts. Therefore this trial was designed to provide insight into methods that are currently used and to inform effective practice across the Teaching School Alliance.

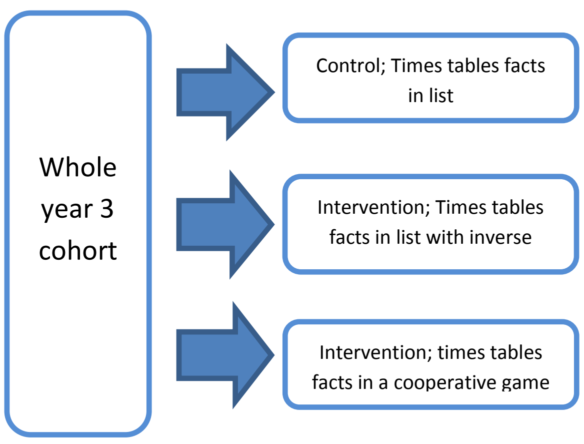
Research Design

A between-subject design was used with a pre and post-test. To address the aims of the research the independent variable (relative effectiveness of different timetable learning methods) was operationalised by creating three conditions

Level 1 (control condition) – learning in a list – normal classroom practice

Level 2 (Intervention A) – learning through problem solving (inverse operations)

Level 3 (Intervention B) – learning though a cooperative times table game



Method

Participants:

All participants were from Year 3 classes in two primary schools in the teaching School Alliance. This allowed the trial to establish whether there were effects across the whole cohort. After the pre-test the children were randomly allocated to one of the 3 conditions (control, inverse operation, cooperative game). The children in the game condition were randomly allocated to their games groups to avoid any sampling bias controlling for gender and gender. A total of 44 pupils took part (25 boys and 19 girls).

Procedure:

All the children were pre-tested using times table sheets. They were asked to complete as many questions as they could in 5 minutes.

The tests were marked and the resultant scores used to stratify the attainment of the children. Children were allocated to a condition controlling for pre-test scores, age and gender.

For 10 minutes a day, at the same time each day, the children completed their times-times learning activities according to their allocation (either in lists, inverse operations or playing the game). The teacher did not intervene in the learning, only monitored the classroom. Any children who were not engaged with the tasks were refocused on their tasks, but otherwise there was no other adult support.

After 5 days, the children were tested again, using the post-test.

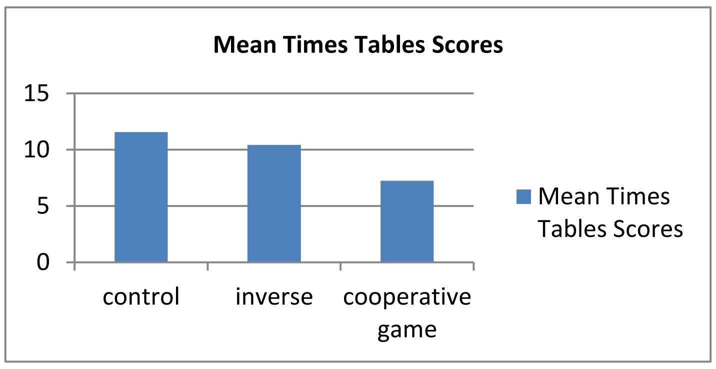
Materials:

- A pre-test, and a post-test of the same times tables facts, randomly generated
- Classroom timer
- Times tables lists to be completed by the children
- Multiplication/division times tables lists to be completed by the children
- POW! A cooperative times tables game to be played in groups
- Instructions for the POW game.

Results

Gain scores were calculated, these were as follows:

- Control 11.56 (SD 17.93)
- Inverse 10.44 (SD 19.35)
- Cooperative game 7.25 (SD 12.46)



As per the convention for studies with more than two conditions, an initial ANOVA across all three conditions suggested that the overall change across all levels of the IV was significant ($p = 0.037$ (two tailed), $n_p^2 = 0.012$), a small effect size. This was then followed by planned comparisons (with a Bonferroni adjusted alpha of 0.0167). The table below shows the effect sizes and levels of significance, comparing all 3 conditions to one another.

	list	inverse	Cooperative game
List		d = 0.06 p =0.852 (two-tailed)	d = 0.27 p = 0.472 (two-tailed)
Inverse	d = -0.06 p = 0.852 (two-tailed)		d = 0.19 p = 0.596 (two-tailed)
Cooperative game	d = -0.27 p = 0.472 (two-tailed)	d = -0.19 p = 0.596 (two-tailed)	

Conclusions

These results appear to indicate that cooperative games are less effective at supporting children to develop fluent recall of times table facts than both the inverse operation learning activity and the list (control) condition. However, all of the results were not significant. With regard to the moderate effect size for cooperative games versus list learning this is likely to have been caused by the relatively small sample size. Power calculation suggests that a future larger study with approximately 342 participants (between-subject design) or 87 (within-subject design) might be able to detect such an effect size as significant. Thus this pilot can be said to have laid out the protocols for an important possible large scale replication.

In conclusion, this small pilot study appears to indicate that existing practice seems to be most effective at supporting fluent recall of these facts. This could suggest that the POW game is effective at teaching children to work cooperatively with each other, but not to fluently recall isolated facts.

Now the design protocol has been piloted in two schools, in one year group, it will be replicated across other schools within the Teaching School Alliance, increasing the sample size and therefore the external validity and generalisability of the findings.

References

Blakemore, S. and Frith, U. (2005) *The Learning Brain, lessons for education*.

Higgins, S., Kototsaki, D and Coe, R. (2012) The teaching and learning toolkit: technical appendices, Durham University: CEM

Ofsted (2011) *Good practice in primary mathematics: evidence from 20 successful schools.* Accessed 24.11.2014 http://www.ofsted.gov.uk/sites/default/files/documents/surveys-and-good-practice/g/Good%20practice%20in%20primary%20mathematics.pdf

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Author(s)

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Research title

Preliminary evidence for the effect of increased motivation and competition intervention in mathematics which appears to be equal to existing practice

The Blue Coat School

Faith Vision Nurture

Purpose of the research:

Research into the influences on students' GCSE attainment and progress at age 16 carried out by the Department for Education points towards homework as a key factor in the mathematical success of a student. One of the key findings in the research was that 'the amount of time students said they spent on homework predicted better academic attainment at GCSE and also better progress across the Key Stages' (Sammon, Sylva, Melhuish, Siraj, Taggart, Toth, Smees; 2014). The purpose of this research was to investigate whether or not increased motivation and competition within mathematics leads to significantly higher student attainment.

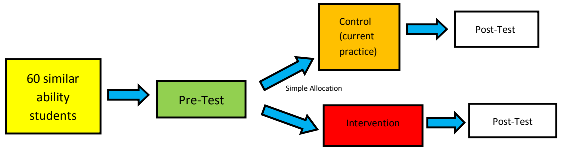
The research design:

A between-subject design was used with a pre- and post-intervention comparison of attainment between classes. To address the aims of the research the independent variable of intervention was operationalised by creating two conditions.

IV Level 1 (Control condition): No intervention

IV Level 2 (Intervention): The introduction of competition in homeworks.

The groups were randomly allocated to control or intervention.



Methods

Participants, sample size and randomisation:

- Two top sets were used for the research. They were randomly allocated for control or intervention.
- In addition, small groups were randomly sampled prior to qualitative interviews. The qualitative interviews were based on the systematic allocation as follows:
  - Students 1, 6, 11, 16 etc in the ranking formed a group for interview.
- The sample size for this study was 30 for the control group and 31 for the intervention group.

Procedures:

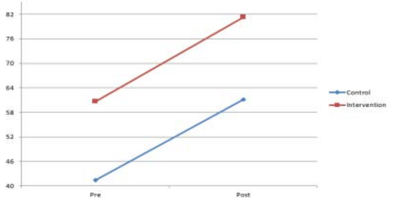
- The students were introduced to a homework league table which paired them up (randomly) against another member of the class each week (they all "played" each other once across the year).
- The system works in a similar way to football and other sports, such that it is 3 points for a win, 1 point for a draw and 0 points for a loss.
- For the vast majority of the time, I did not show the students who they were facing for that week until after the homeworks were in.
- Assessments continued as normal in the scheme of work (with the control group and the intervention group).

Materials (and apparatus):

- Homework league table (Microsoft Excel Spreadsheet).
- End of topic assessments.
- Pre- and post- questionnaires.

Results:

Gains scores were calculated and an independent samples t-test was used to compare the progress made by pupils in the intervention to those in the control condition. This showed a small ($d = 0.114$) but non-significant ($p = 0.652$ (two-tailed)) effect.



Conclusions and recommendations for future research:

This research suggests that there was no difference in progress rates for the intervention compared to the control indicating that the intervention could be used safely as an alternative treatment to existing practice.

Although there was no significant difference in attainment, there was a small positive effect. In addition, qualitative interviews with the students suggest that the students in this trial were much more motivated in the intervention lessons.

A larger replicated study in which both motivation and attainment are measured is recommended. This may be worth considering as a form of intervention in the future since costs are low, enthusiasm for the subject appears to grow and it is not detrimental to exam scores.

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Teamworks TSA (The Greetland Academy)

Teamworks Teaching School Alliance

The Greetland Academy

Meta cognition and maths attainment.

Natalie Booth and Elkie Bailes

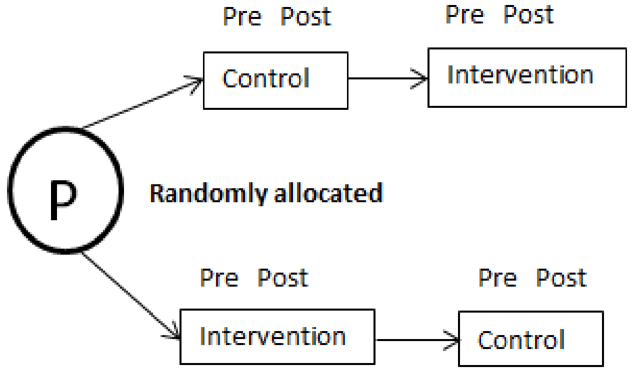
Introduction

The impact of meta-cognition on maths attainment is an important area to explore because findings suggest that meta-cognition can have positive impacts in children's attainment (EEF Meta-cognition and self-regulation 2015), however there has been some debate about the age at which learners are capable of self regulation (Donker et al 2014). If video is shown to have a greater impact than teacher guidance alone, this could be implemented in the classroom and offer potential gains to pupil attainment.

The project builds on a pilot study in which pupils' ability to improve their maths attainment through meta-cognitive skills were explored using the medium of video as a pedagogical tool. In the pilot study, Year 1 pupils were filmed undertaking problem solving tasks in maths. The pupils then watched the film with a teacher who questioned them about what they were doing at each stage and they undertook a second problem solving task. This initial study suggested a positive impact but there was no control condition with which to compare.

Research design

Pre and post-test, counterbalanced within subject design with two conditions. To address the aims of the research, the independent variable (video use) was operationalised by creating two counterbalanced conditions.



Independent variable (IV) level 1 (Control condition): teacher input only.
Independent variable (IV) level 2 (Intervention): use of video for review.

Method

Participants

The participants were Year 2 children, all taught by the same teacher. The participants included 18 boys and 11 girls from a rural English primary school, randomly allocated to the order of which they experienced the condition.

Materials

- Iris cameras
- Ipads
- SAT's papers for pre and post test scores
- Two practical maths tasks

Procedure

Meta-cognition was defined as 'becoming retrospectively aware of how an individual approaches a mathematical problem by allowing them to watch a reflection video of themselves previously doing the task.'

There was one dependant variable: maths attainment as measured by performance on an external test.

The participants were tested initially on a SATs paper that had been adapted to cover the same area of maths as the practical task. Participants were divided into two groups (C-I and I-C). One group at a time received maths input whilst the rest of the class were taken for an alternative lesson with another teacher. Participants were given a practical task with instructions and asked to complete the task in 2 minutes. When receiving the intervention, the participants were filmed undertaking the maths task and then watched themselves back with the teacher. The teacher questioned the pupils (with non-probing questions) about what they were doing at each stage.

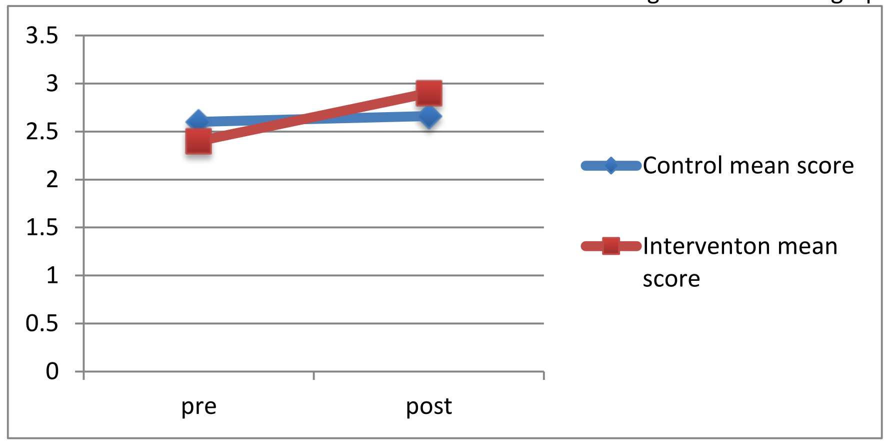
The control group followed the same procedure but instead of watching themselves back, they were given feedback and questioning from the teacher alone. Both groups were post tested against SATs papers. The groups were swapped to experience the opposite condition. For consistency, the participants were given the same tasks, tests and teacher.

Results

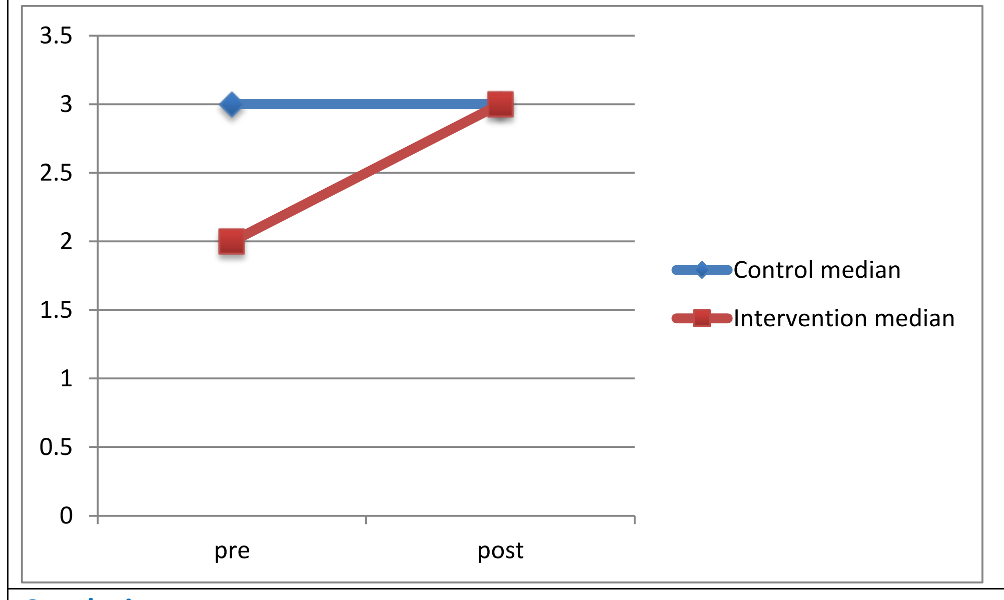
There was one dependant variable, maths attainment

Quantitative

Gain scores were first calculated for maths attainment using the data in the graph below.



A Wilcoxon-signed rank test was then used. This indicated a significant improvement ($p = 0.01$) in maths attainment when the pupils were exposed to the metacognitive strategies compare to the control. A medium effect size ($r = 0.27$).
The distribution of the data was non-normal, median scores can be found in the figure below.



Conclusion

Meta-cognitive strategies improve Year Two maths progress in an English rural primary school with quantitative research showing a significant effect on children's attainment ($p = 0.01$). It should be acknowledged that the pre and post testing involved different SATs questions with a higher level of questioning on the post test. It is recommended that meta-cognition is used as an educational learning tool.
Further research could include testing the impact of meta-cognition as a method for whole class learning development in maths. The study could also be replicated in schools with varying socio-economic intake.

The Vale Primary Academy

Preliminary evidence regarding the effect of personal interest-based learning on progress in Early Years classrooms.

New Dimension Teaching School Alliance – (School Partnership Trust Academies)
The Vale Primary Academy – Knottingley, West Yorkshire.
Research conducted by: Mrs Joanne Groves, Mrs L Skelding, Mrs S Brain, Mrs E Wallace, Mrs L Keetley, Mrs S Jarratt, Mr John Parkin.

Introduction

The Vale Primary Academy serves a catchment area of predominantly 'white-British' children from lower economic backgrounds. These children enter the foundation unit at the age of three, with the majority of the cohort significantly behind the age-related expectations in most areas of learning. The DfE funded EPPE study (Effective Provision of Preschool) found that children made better progress than their peers when attending nursery settings that viewed "educational and social development as complementary and equal in importance" it also found that the better progress was made in settings that provided "instructive learning environments and sustained shared thinking to extend children's learning." Enthused by the findings of the EPPE study the school decided to study the effect of learning through areas of interest and its effect on children's attainment in maths.

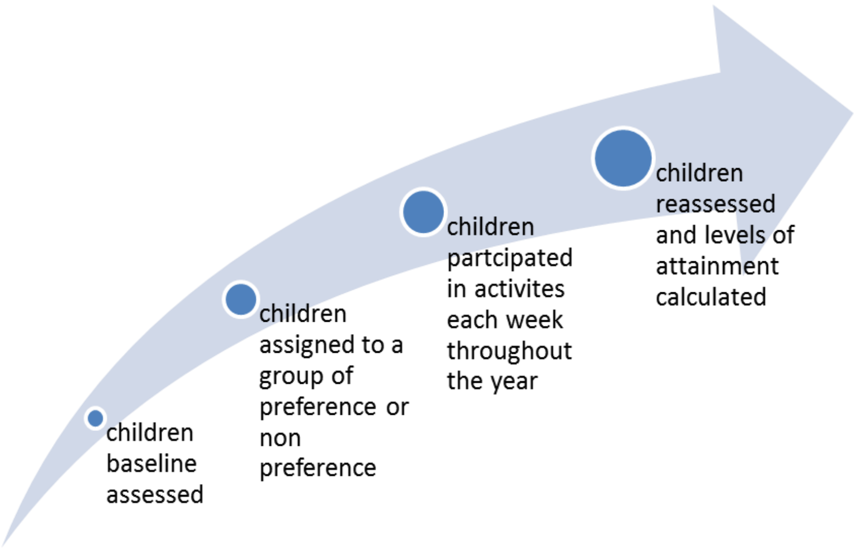
Research design

A non-randomised, matched-pair design was used with pre- and post-test assessment To address the aims of the research the independent variable (personal interest-based learning) was defined operationally by creating two conditions:

Level 1 (Control condition): No intervention

Level 2 (Intervention): Personal interest based learning

The children were grouped according to their area of interest. This was done through observation and in consultation with parents and carers. The main areas of interest were noted to be: art, construction, food, IT and Nature. Children were grouped according to preference. A control cohort of children was specifically assigned to groups that were not of interest to that child. The children were assessed as a baseline indicator against the 'Development Matters' age related expectations. This was then converted into a numerical score. The children participated in sustained shared thinking activities each week. The assessment process was then repeated at the cessation of the project and the difference in attainment calculated.



Method

Participants

- Seventy one pupils were allocated into two groups according to their parents' understanding of their areas of interest. For a group of children, the areas of interest as defined by the parents differed from those identified by the practitioners within the setting. From these initially unequal groups, twenty four matched-pairs were allocated. The factors accounted for were: age, full-time or part-time, gender and current assessed ability (based upon their most recent assessments against the 'Development Matters' age-related expectations).
- One group (those where parent choice differed from practitioners) experienced the 'normal' Early Years Foundation Stage learning opportunities as planned and available within the setting throughout the year. The other group (those where there was agreement between parents and practitioners) experienced the same concepts but contextualised within learning environments devised around their interests.

Procedure

- One group of pupils were allowed their 'free-choice' of activity areas on a daily basis in the setting – the second group were encouraged to learn within environments based upon their personal interests.
- Simple lesson plans were created to cater for each preference area;
- Examples of lessons offered to groups are: Nature- snail racing and worm charming. Art- sculpting and painting. Construction- den building and box modelling. Food- sweet making and wedding cakes. IT- Green screen movies and QR code treasure hunts;
- Time to share and discuss the different groups' experiences was planned for the end of each session;
- At the end of the trial, pupils were re-assessed using the same teacher assessment and moderation systems used to establish the baseline. They were identified as high, secure or low within their assigned attainment age-band;
- The assessments across the range of age-bands were assigned a numerical value thereby facilitating the calculation of a numerical progress measure across the time period of the project (October 2014 to June 2015);
- Pre- and post-learning intervention scores for the two groups were analysed and conclusions drawn against the initial hypothesis.

Materials

- Assessment was carried out using the methods current in the Early Years Foundation Stage – this is teacher/other significant adult observational assessment that is moderated within the setting, across partner settings and through local authority EYFS moderation meetings.
- Resources pertinent to the personal interests of the pupils (posters, toys, books, ICT etc.) were purchased.
- The EYFS setting uses a 'cloud-based' iPad recording system (Orbit) to evidence pupil achievement or progress against a particular Early Learning Goal.

Results

Gain scores were first calculated for each of the three dependent variables (maths attainment, literacy and PSED) (see Figures 1 – 3, below).

Figure 1 – Maths gain

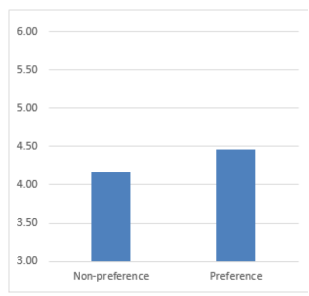


Figure 2 – Literacy gain

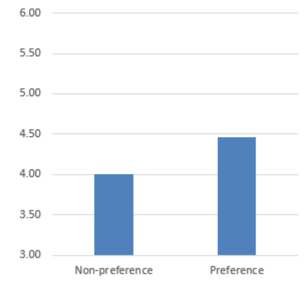
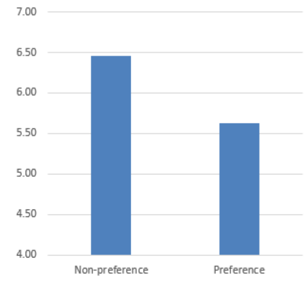


Figure 3 – PSED gain



As anticipated, because of the small sample size, a paired samples t-test indicated no difference ($p = 0.289$, one-tailed) between the maths progress rates of the learners in the non-preference group ($M = 4.17$, $SD = 2.30$) compared to preference group ($M = 4.46$, $SD = 1.47$). A small positive effect on progress was, however, detected ($d_z = 0.119$). Literacy and PSED results were not normally distributed therefore a Wilcoxon signed-rank test was used. This indicated similar results for both literacy ($p = 0.185$, $r = 0.087$) and PSED. However, a moderate negative effect on PSED progress rate approached significance ($p = 0.08$, $r = -0.234$).

Conclusions

It was not expected that a study of this size would detect a significant change in the progress of children who experienced the intervention. This said, these preliminary results suggest that teachers may have more freedom with regard to the effects of pupil choice on maths and literacy attainment with preference-orientated lessons benefiting children slightly more than non-preference lessons. However, there may be an opposite negative effect on PSED progress rates where children are allowed to make their own choices – perhaps the result of children choosing to work with others they already feel comfortable with, rather than being stretched to interact more widely. A larger replication is recommended to establish these findings more clearly.

The effect of physical activity on academic performance of pupils in maths - evidence from a preliminary small scale pilot study.

Researcher – Danielle Kingham
Sacred Heart Catholic Primary School & Blue Sky Teaching School Alliance

Introduction

The significance of physical activity in primary schools has been debated in length in recent years. The ever growing number of children suffering from childhood obesity has been one of the reasons for this but it has also been argued that its effects have a much wider reach. It has been said that physical activity is important for motor development and loco motor skills in particular. Shenouda et al. (2011:1) suggests that 'children who spend the most time in moderate to vigorous physical activity tend to have the highest motor skill.' Thus impacting on other elements of their education. Martin (2010, p.5) suggests that 'acute bouts of physical activity exert short term benefits on children's cognitive functioning.' Martin (2010) also discusses the possibility that exercise can stimulate nerve growth and can increase blood flow to the brain which could put children in an optimum condition for maximizing learning. Martin (2010 p.2) states that; 'sport and other forms of physical activity are also thought to lead to enhancement of cognitive functioning, memory, concentration, behavior and academic achievement for children.' If this statement is correct then I could see a significant difference in the performance of children who take part in physical activity before a lesson. It will be difficult however to link any improvement in performance directly to the physical activity with complete certainty. There are many factors that could contribute to this, for example, children's natural progression. Using two classes and looking at the difference in their progress with and without physical activity will give me an insight into the link.

Research design

A between-subject design was used with a pre- and post-test. To address the aims of the research the independent variable (mind gym activity) was defined operationally by creating two conditions.

IV Level 1 – Normal classroom practice prior to a maths test (control condition)
IV Level 2 – 10 minutes of mind gym prior to a maths test (experimental condition).

Method

Participants

Two already existing stratified classes (based on SEN, PP, EAL and gender) in year three were then randomly allocated to the control or intervention. The total of pupils who took part in the study was 60 (34 boys and 26 girls).

Procedure

Children took part in a mind gym/physical activity called 'activate' for 5 minutes before their maths lesson once a week. This consisted of a video that included moving around and doing light physical activity as well as making figure of eights in the air with both hands to improve concentration.

Children completed a test on the first week without doing the physical activity. They also completed a questionnaire about how they felt about maths. They then completed a further 6 weeks of 'activate' followed by a maths test. The children completed a final post-test and the same questionnaire from the start of the research project.

Materials

'Activate' - Inclusive, whole class, age levelled, progressive exercise programmes that improve agility, balance, co-ordination and concentration.

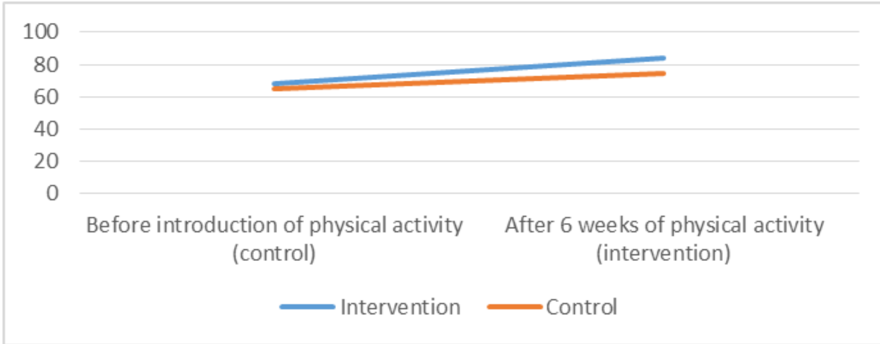
Test – A simple times tables test that they had 10 minutes to complete.

Questionnaire – Asking the children if they like maths and what they like and dislike about it.

Results

Test Results

Gain scores were first calculated. A Mann-Whitney U test indicated a significant ($p = 0.016$ (one-tailed)) positive and moderate effect ($r = 0.314$) for the intervention (mdn = 17.2) compared to the control (mdn = 7.7).



Enjoyment questionnaire results

Data in the contingency tables below suggested that children enjoyed maths more in the mind gym lessons.

Number of control group children enjoying maths before and after treatment

	Pre	Post
Enjoyed	10	14
Not enjoyed	20	16

Number of intervention group children enjoying maths before and after treatment

	Pre	Post
Enjoyed	10	28
Not enjoyed	20	2

A chi-squared test of independence indicated a significant improvement in enjoyment during the mind gym lesson ($p = 0.001$), large effect size ($w = 0.62$). However, there was no difference in the control group ($p = 0.45$).

Conclusions

Physical activity makes a significant different to maths attainment when completed for 10 minutes prior to a test. However this benefit appears to only occur after 3 weeks of practice.

Questionnaire data, however, indicated that children enjoyed doing the maths tests more when these were preceded with the physical activity.

Future research should replicate the pilot study with a larger sample size.

Research and Development Teams

Increasing involvement of Teaching Assistants in reviewing intervention programmes accelerates progress with SEN pupils to close the gap in Mathematics.

by Rwth Sloan rwth.sloan@meadowbank.stockport.sch.uk

Introduction

Across our teaching school alliance, RAISE analysis shows the gap between SEN pupils and other children requires further investigation. Data shows that in many instances children with additional needs are not performing as their peers do nationally and therefore the gap between their own performance and that of the rest of the children is not closing.

The Sutton Trust research reviewed the impact of support staff in schools and found little or no effect on pupil attainment. There is evidence that there is greater impact when teaching assistants are given responsibility in specific curriculum interventions. The more involved the teaching assistant is in planning and reviewing the intervention the greater the academic gains. (Education Endowment Trust 2011)

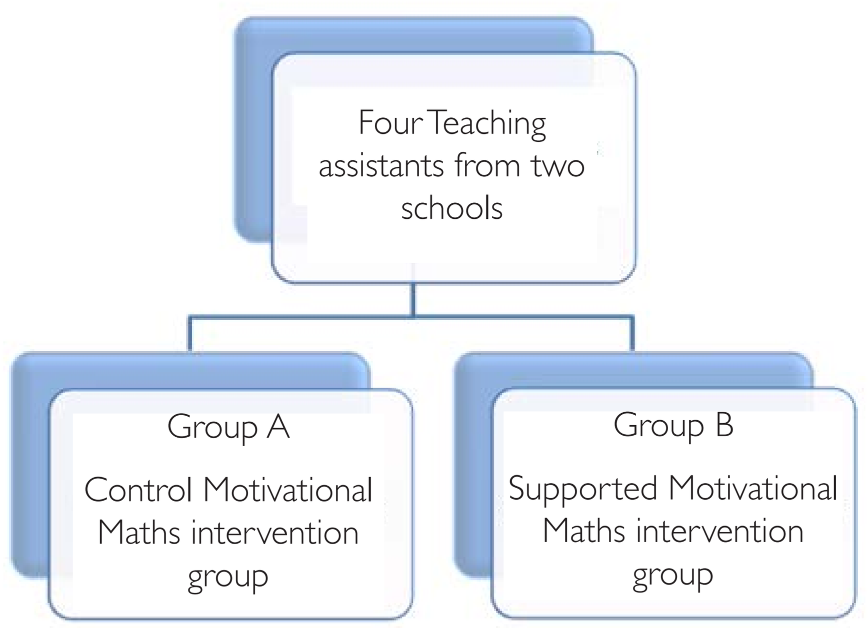
Research design

A between-subject design was used. A pre- and post- maths test was carried out to establish any difference in rates of progress between the control and experimental groups.

To address the aims of the research the independent variable, Teaching Assistant deployment, was operationalised by creating 2 conditions.

IV Level 1 (Control condition): Teaching Assistants delivering a prescribed intervention programme

IV Level 2 (Intervention): Teaching Assistants delivering the same intervention, but involved in regular reviews with the SENCO throughout the programme.



Method

Participants

Two schools SENCO's identified two Teaching Assistants from their schools to administer a prescribed maths intervention programme to children in year 3 and 4. The children chosen were randomly allocate to each teaching assistant ensuring that they were chosen from the school support stage of the register for learning needs only. The same number of children were chosen for each condition with a gender balance in one school but a girl heavy sample in the other school (20 children in total). The Teaching Assistants were then randomly allocated the group by tossing a coin – heads for intervention and tails for control.

Procedure

Initially Motivational Maths intervention programme training was delivered to the SENCOs and Teaching Assistant's. The SENCO's then randomly allocate children and support staff to the two groups. The children were assessed at the beginning and end of the five week programme which was delivered the same time for 30 minutes three times a week in the same place for the sessions to avoid potentially confounding variables such as variable noise level in different areas.

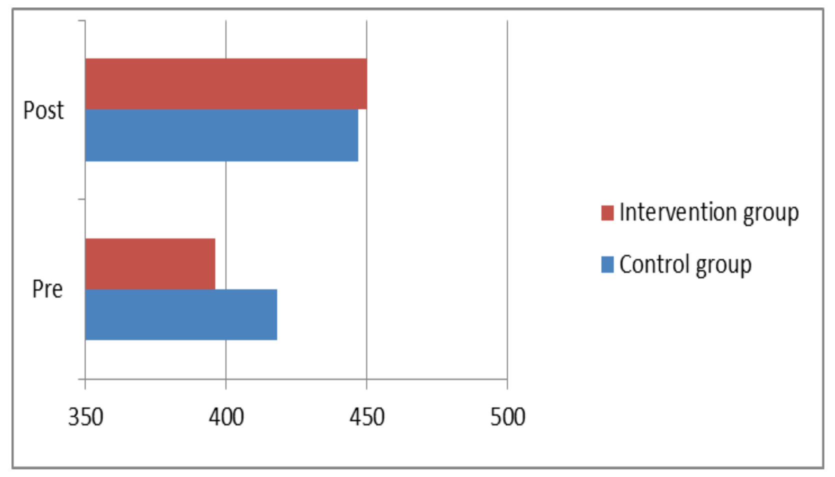
The teaching assistant allocated to the supported Motivational maths group met with the SENCO each week to discuss the needs of the children and review the programme. The teaching assistant allocated to the control group implemented the programme without these additional discussions.

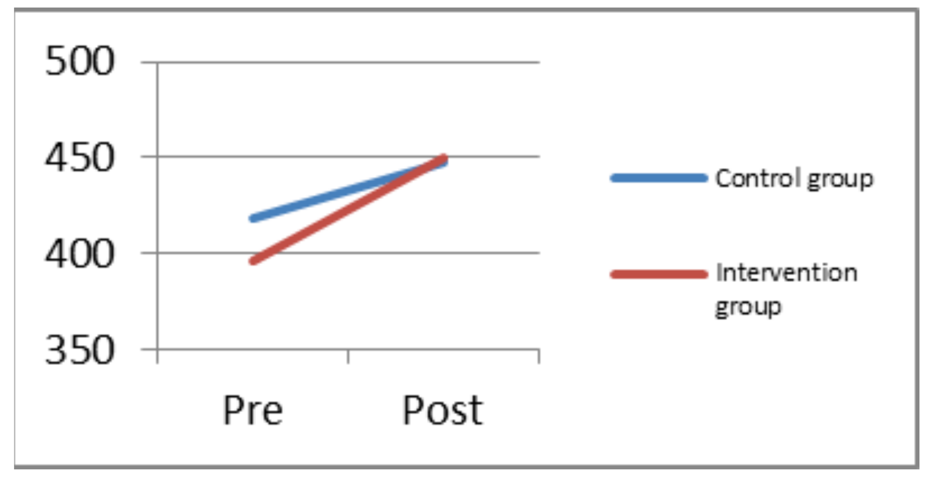
Materials

Motivational Maths training and resources were shared with the support staff and the Carol Bight Assessment tool was used for the pre and post intervention tests to assess the attainment of the children. All the Teaching Assistants had access to the resources but only one from each school had weekly support and guidance from the SENCO.

Results

Gain scores were first calculated from the data in the graph. A Mann-Whitney U test indicated a significant ($p=0.029$ (one tailed)) improvement in attainment for pupils who were exposed to the supported Motivational Maths intervention (Mdn= 5.5) compared to the control motivational maths intervention (Mdn = 2.5). This represented a medium effect size ($r= 0.399$).





Conclusions

The Intervention group in both schools made either a medium or large effect size. Throughout the research the Teaching Assistants receiving additional guidance and support were keen to review their group's attainment and discuss next steps. Although one Teaching Assistant received additional support the Teaching Assistants themselves developed a mutually supportive relationship and worked on the project as a team, developing many sessions and resources jointly. All the groups made progress using Motivational Maths – Carol Bright assessment. The intervention group in both schools scored higher than the control group. All the children made gains ranging from 26 to 1.

Because of the small sample size the data does not show that the progress made could not be attributed to chance. Future research may want to use a wider sample of Teaching Assistants as the sample size becomes bigger the effect of chance would be reduced.

Evidence from a preliminary non-randomised feasibility study into the effect of Building Learning Power on maths attainment.

Introduction

There is currently much discussion in the education World about developing a child's learning character. The schools in this study believe that explicitly developing children's natural learning behaviours will enable them to do just that. For the past two years we have invested time, research and energy into using the 'Building Learning Power' framework to explore how our children learn and how we can enable them to build their capacity to use their learning behaviours more effectively on the road to increased independence. The results we have had so far encouraged to us to undertake a more structured approach in evaluating the impact of our work.

Research design

Study 1 – A pre and post-test non-randomised parallel group design was used with two conditions.

- Group 1 – Year one pupils with no exposure to BLP (n = 12)
- Group 2 – Year one pupils from a similar school exposed to BLP (n = 30)

Dependent variable: (B) Maths attainment as measured by teacher assessment across 5 stages of maths learning in multiplication (B) Learning behaviour assessment.

Study 2 - In parallel, the teachers of a large of group of children from other year groups in the intervention group's school, plus 4 other groups of children in similar schools (n =270 in total), conducted a learning behaviour assessment and the same maths assessment as in study 1.

Dependent variables: (A) Maths attainment as measured by teacher assessment across 5 stages of maths learning in multiplication (B) Learning behaviour assessment

Method

Participants

There were six primary schools involved in the project; one as a control school and 5 as intervention. All of the intervention schools have been part of a structured training programme for BLP over the past 2 years. They came to understand the capacities of successful learners and ways of enabling these in the classroom. They undertook learning enquiries aimed at developing their practice as teachers and making a culture shift in their classrooms.

Procedure

Changes to the National assessment process led us to creating our own method of measuring progress in Maths, focussing on multiplication. Our curriculum model was to ensure dual focussed lessons were taught in a sequence which enabled children to *CONNECT* to the learning behaviour and content, *STRTECH* the learning behaviour to access the content and *TRANSFER* the learning behaviour and content to undertake more open ended challenges. The learning behaviours selected were questioning and making links. The model was carried out over 8 maths lessons within a 3 week period.

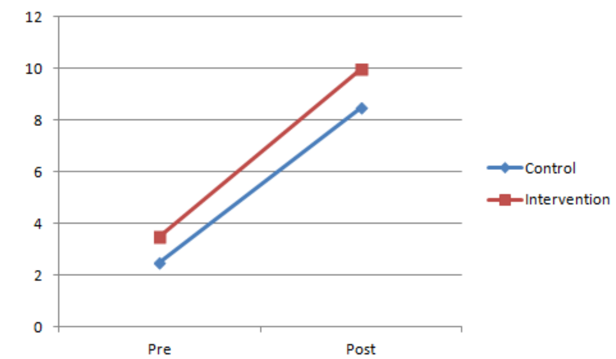
Materials

Lessons were designed by each individual teacher. Access to the TLO Activity Bank for BLP supported some teachers in doing this. The curriculum model was introduced in previous BLP training from TLO. TLO learning behaviour progression charts were used to measure entry and exit data. Maths data was collected using a process agreed by all of the schools.

Results

Study 1 (DV : A)

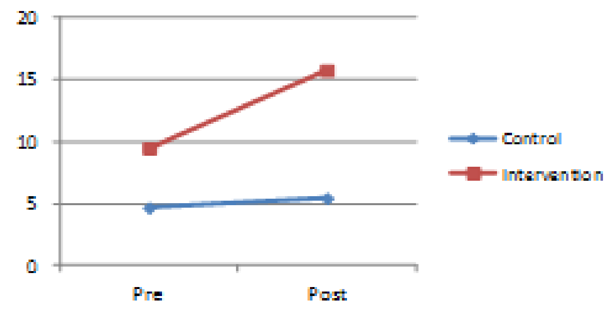
Gain scores for maths attainment were first calculated using the data in the graph below.



Because the data was non-normally distributed with an imbalanced samples size, a Mann-Whitney U test was used. This indicated a significant (p > 0.005) difference in the maths progress of year one students exposed to building learning power (mdn = 4.0) compared to those who were not (mdn = 1). A large effect size (R= 0.66)

Study 1 (DV : B)

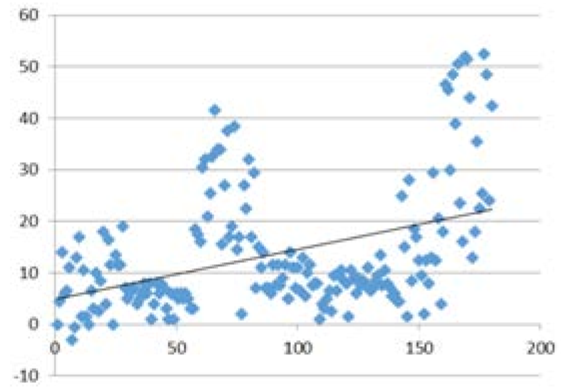
Gain scores for learning behaviours were first calculated using the data in the graph below.



Because the data was non-normally distributed with an imbalanced samples size, a Mann-Whitney U test was used. This indicated a significant (p = 0.000) difference in the learning behaviour progress of year one students exposed to building learning power (mdn = 6.0) compared to those who were not (mdn = 0.5). A large effect size (r= 0.77).

Study 2

Spearman's rank correlation coefficient was used to test the hypothesis that there is a relationship between age and learning behaviour progression. The graph below illustrates the moderately large positive relationship (Rho = 0.5, p = 0.003).



Learning behaviour and maths attainment were also positively correlated (Rho = 0.6, p = 0.002).

A further analysis looked at the gain scores for all the uncontrolled year groups in the intervention schools and found these be similar to the amount of gain achieved within the year 1 class that took part in the trial.

Conclusions

These results suggest that the explicit development of learning behaviours is beneficial to all children, regardless of age. This suggests that focussing on how we learn as well as what, will increase attainment more rapidly. More research will done with future design both randomising and looking at **s**eparate year groups independently.

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