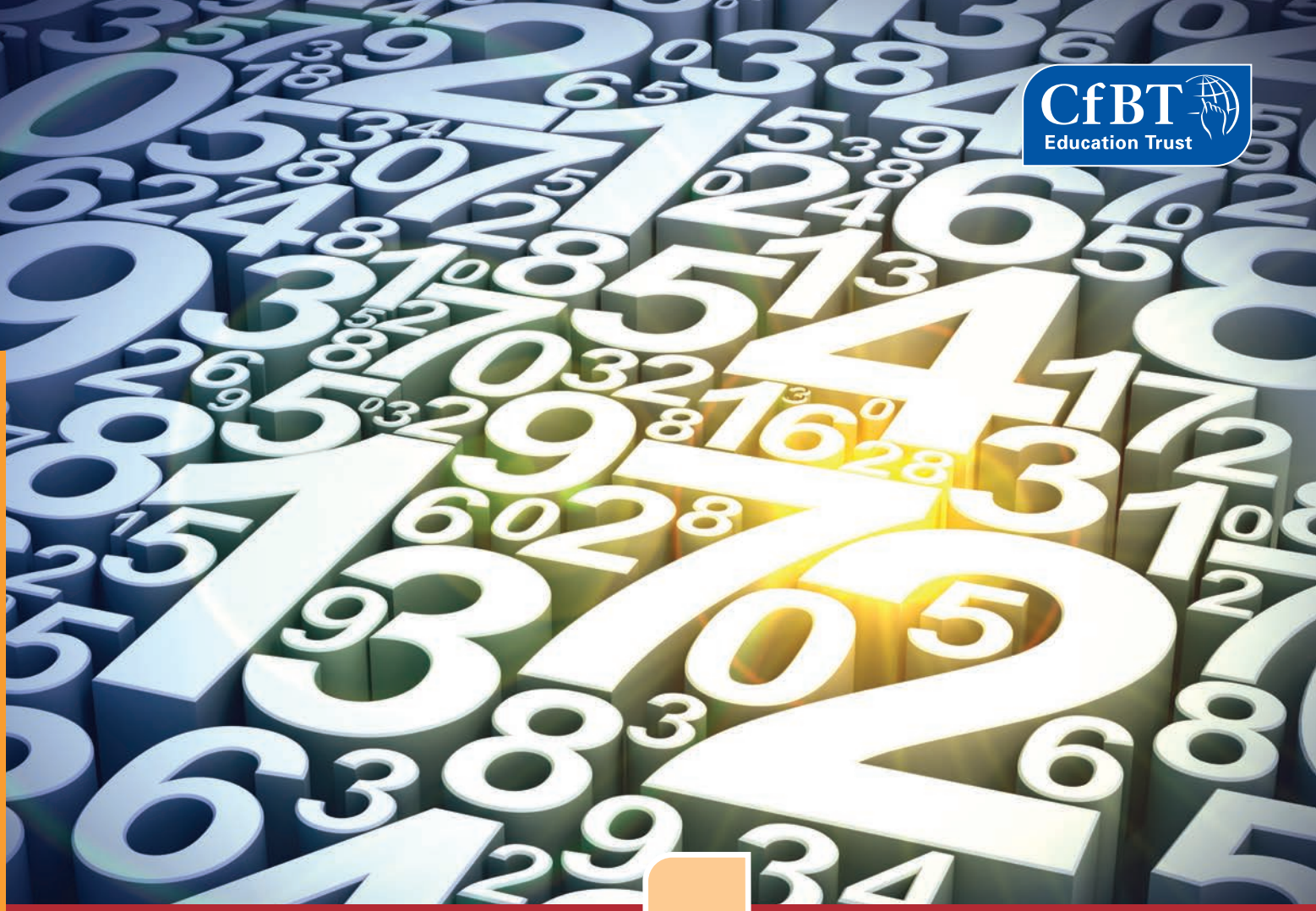

Raising maths attainment through enhanced pedagogy and communication

Results from a 'teacher-level' randomised controlled trial

Richard Churches
Fiona Allan

CfBT Education Trust

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Acknowledgements

We would like to acknowledge the contribution of the Learning and Skills Improvement Service in funding this research and CfBT Education Trust in providing additional research support and expertise. We consulted Dr Paul Tosey, University of Surrey, in relation to the ethical application of NLP within the research design. The Skills for Life Development Centre, University of Sussex Innovation Centre, monitored and controlled all data security, entry and analysis. We should also acknowledge the contribution of all those who were involved in the mentoring and administration of the training and research programme: Richard Goss, Cathy McDonnell, Debbie Miller, Debbie Megnauth, Karen Whitby, Kim Bray, Roger Terry, Emily Terry. Finally, this research would not have been possible without the commitment of the adult numeracy teachers and their learners.

Background to this paper

This paper presents an edited and revised version of the conference paper delivered at the international NLP research conference at the University of Hertfordshire in 2011, shared at the House of Lords All Party Parliamentary Group on Brain-Science in the Classroom and the subsequent journal article (Allan et al., 2013).

The original research and paper were the work of the following research team:

Fiona Allan – National Centre for Excellence in the Teaching of Mathematics

Jo Bourne – CfBT Education Trust

Richard Churches – CfBT Education Trust

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Lisa Rhodes – CfBT Education Trust

Research summary

CfBT Education Trust has had a long engagement with the adult learning sector and particularly with the area of adult numeracy. The organisation has also published two research papers on neuro-linguistic programming (NLP) and its potential in education, including a systematic literature review. The literature on adult numeracy suggests that pedagogy may be less effective if the relationship between teacher and learner does not reflect sensitivity to attitudes, beliefs and classroom emotional climate, areas in which advocates of NLP claim effectiveness.

The research design for the present study took the form of a large-scale randomised controlled trial carried out over a six-month period. The study used established government adult numeracy tests before and after the three interventions. The analysis compared the effects of: a) teachers trained in approaches to hypnotic language and body language (as they appear in the NLP model) combined with innovative maths pedagogy, with b) teachers who just received maths continuing professional development (CPD), and c) a baseline control condition (learners whose teachers received no training or CPD).

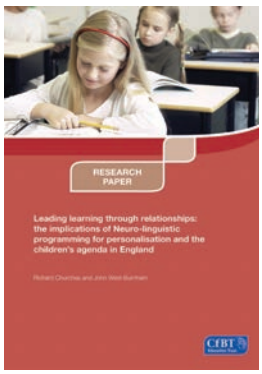
The addition of NLP training produced a significant improvement in maths attainment. The increase in mean difference for this group was over three times that of the control group and approximately one and a half times that of the 'maths training only' group. Results suggest that some NLP training may be helpful to maths teachers where a baseline of effective pedagogy is in place.

The results of this study support approaches recommended by the National Centre for Excellence in the Teaching of Mathematics, while indicating that teachers' communication skills amplify or attenuate the effectiveness of such pedagogy, and that where teachers receive training in communication strategies from therapy that aims to create a stable emotional climate, attainment is significantly greater.

Future research may wish to look at whether simply training language patterns or body language still results in the same increase in attainment.

1 Introduction

Neuro-linguistic programming approaches and education



With the exception of the NLP Spelling Strategy (Malloy, 1989; 1995), most of the evidence in support of using NLP in education suggests benefits in relation to areas like effective communication, engagement, questioning and classroom climate, rather than specific classroom pedagogy. In a CfBT Education Trust paper, which was subsequently revised for the NLP research journal (2009), Churches and West-Burnham (2008), for example, associate the potential benefits of NLP in teaching with ideas about emotional climate (teachers' management of their own emotions and those of their learners) and the importance of this for effective learning. Of particular relevance to this present study are the follow-up 24 teacher-led action research case studies detailed in Carey et al. (2010; 2011) published by CfBT and funded by the Training and Development Agency for Schools. Teachers suggested the following benefits after receiving NLP training in relation to pupil outcomes:

- improvements in the affective side of learning
- some initial evidence in relation to improvements in attainment, knowledge and understanding
- positive changes in attitude
- better predisposition towards subjects
- improved self-concept
- better acceptance of responsibility for actions and behaviours
- improved classroom behaviour
- pupils being more active in their learning in the classroom
- more engagement in discussions.

Carey et al. (2011) note particularly the potential benefits of teachers learning language patterns modelled from hypnosis, body language and emotional state management techniques, but acknowledge the limitations of evidence provided by small-scale teacher-led action research. Carey and colleagues therefore suggest the use of a randomised controlled trial to take this forward.

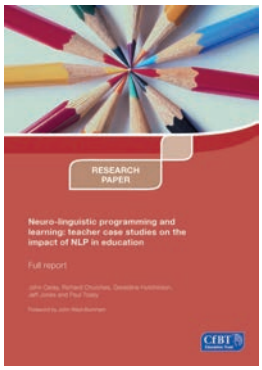
What is NLP and where did it come from?

Neuro-linguistic programming (NLP) publications frequently claim to have modelled the subjective experience of highly able people (particularly in relation to communication skills) in a way that enables the transfer of effectiveness, both within and across disciplines (see Tosey and Mathison (2009) for an academic appraisal of the field and its development). The earliest NLP publications originated when Richard Bandler and John Grinder (the co-founders of NLP) were a student and associate professor of linguistics at the University of Santa Cruz in California in the mid-1970s. Their early books document the use of the NLP process of modelling with hypnotherapists and family therapists such as Milton Erickson and Virginia Satir (Bandler and Grinder, 1975a; 1975b; 1979; Bandler et al., 1976; Grinder and Bandler, 1976). These contain the first publication of their ideas about language (verbal and non-verbal), the use of NLP approaches to investigate subjective experience and the internal mental processes which people are capable of perceiving.

NLP in education

The first book to discuss teachers and classroom practice with NLP appeared in 1982 (Harper, 1982), although an earlier publication looked at the development of self-esteem with children and teenagers (Anderson, 1981). Robert Dilts then produced a book which contained a specific chapter on NLP in education (Dilts, 1983), originally written in 1981. Also in that year, Sidney Jacobson published the first of three extensive volumes on NLP and education (Jacobson, 1983; 1986a; 1986b). Over the next 20 years, over 20 further related publications were produced (see Carey et al., 2010 for a detailed review). As a result of the evidence in relation to communication skills and teaching (for example Muijs and Reynolds, 2011), NLP skills have in recent years been increasingly associated with the teacher effectiveness literature (Churches and West-Burnham, 2008; 2009; Carey et al., 2010; 2011; Vieira and Gaspar, 2012).

Academic interest in NLP



From an academic perspective, there has been a developing interest in research into NLP in recent years, with calls for academic commentary to become more evidence-based (Tosey and Mathison, 2009) rather than speculative and theoretical. In education specifically, there has been a significant growth in the publication of research evidence on NLP. In 2010, CfBT published the first systematic literature review (Carey et al., 2010). This reviewed the content of 111 references, including studies that contain research evidence. The authors identified 52 papers that claimed to contain research evidence supporting the use of NLP in education, from 27 qualitative, seven mixed-method and 18 quantitative education-related studies. The review identified six quantitative studies that claimed disconfirmatory evidence. None of the disconfirmatory studies were specifically in the area of adult numeracy learning, or classroom-based maths teaching in general. There were no large-scale classroom-based randomised controlled trials, thus making this present research the first such study.

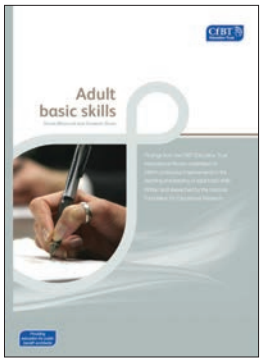
Updating the 2010 CfBT literature review prior to this research

Before carrying out the present research, a further search of the same databases used by Carey and colleagues in 2010 was undertaken. Between 2009 and 2011 an additional ten education-related papers referencing NLP were published (el Gany et al., 2010; Carey et al., 2011; Jones, 2010; Kudliskis and Burden, 2009; Mohsin, 2010; Ran, 2009; Salmas-Villarreal, 2010; Saunders, 2009;

Sibley, 2009; Slater et al., 2010; Tosey and Mathison, 2010). None of these contained evidence about the effectiveness of NLP in adult numeracy, or maths teaching specifically. However, two studies (Pishghadam et al., 2011a; 2011b) report statistically-significant positive correlations between teacher success in English language teaching and NLP.

Adult numeracy, emotional climate and pedagogy

Three recent papers illustrate the need for more research into adult numeracy and effective pedagogy (MacLeod and Straw, 2010; NIACE, 2011; NRDC, 2010). In terms of progress, adult numeracy still lags behind progress in literacy in England (NIACE, 2011). Some of the contributing factors to this are clear from a recent extensive literature review by the National Research and Development Centre for Adult Literacy and Numeracy (NRDC, 2010). This endorsed earlier findings that suggest adult numeracy teaching is both under-researched and generally lacking a strong theoretical basis (Coben, 2003).



The CfBT literature review into adult basic skills also illustrates that there is only a limited research base currently in this area, compared with other areas of adult learning, particularly in relation to pedagogy (MacLeod and Straw, 2010). The NRDC review looked at academic literature, practitioner-focused publications, government reports and large-scale representative surveys. The review noted the importance of areas such as students' self-perception of their numeracy difficulties (DfES, 2003) and that the gap between assessed and perceived skills is even greater in numeracy than it is for literacy (Bynner and Parsons, 2006). In relation to the climate that teachers create in their classrooms, teachers who are effective are able to motivate learners to persist (Lopez et al., 2007; Swain et al., 2005) and deal with the high level of anxiety and fear that is felt by many adult numeracy learners (Sewell, 1981; Meader, 2000). These anxieties often originate from early childhood and can be traumatic and long-lasting (Coben and Thumpston, 1996). Anxiety may also weaken memory, logical thinking and the ability to work methodically (Ashcraft, 2002). The nature of the relationship between the learner and teacher itself may therefore have a significant impact, with effective teachers being sensitive to the attitudes, beliefs and emotions of their learners (Coben, 2005). By extension it could be argued that adult numeracy teachers need the skills to deal with these areas effectively.

In terms of pedagogy, research evidence suggests that engagement and making maths meaningful is important (Safford, 2000; Baker, 2005), as is the teaching of abstract concepts, not just basic numeracy (Swain et al., 2005). Safford, for example, argues for a constructivist approach in which learners should be allowed to work out the general rules of mathematics from exploratory situations (Safford, 2000). 'Bad' practice is seen as involving the application of procedures without understanding (Swain, 2005). High levels of effective questioning, collaboration and engagement, in which learners are challenged to think for themselves, may therefore be more effective (Swain and Swan, 2007). In addition, the need to focus on the development of effective models for mathematics teaching rather than merely the identification and recruitment of the most mathematically talented individuals is becoming increasingly clear across all education phases (Burghes and Robinson, 2009).

Principles for effective teaching in adult numeracy

Principles for more innovative and effective adult numeracy teaching have been defined by the National Centre for Excellence in the Teaching of Mathematics (NCETM, 2008). These build on earlier research by Swain and Swan (2007). The report also encouraged the use of appropriate technology, the confrontation of difficulties rather than avoidance, a greater use of mathematical language and the need to ensure that learners understand how they have learned things, as well as what they have learned. However, no controlled research studies have tested these claims.

How NLP communication strategies might benefit adult numeracy teachers

It would appear from a review of the literature that achieving effective adult numeracy pedagogy might require the inclusion of training that supports teachers to develop more effective communication skills (in order to deal with issues of learners' anxiety, fear and motivation), as well as the types of effective pedagogy described above. In such a context, communication skills usually found in therapeutic contexts might be useful.

2 The research project

Designing the research in response to the literature review

This research study has sought to

- integrate two domains: NLP influencing strategies and innovative maths pedagogy – including approaches such as higher levels of collaborative learning, challenge, engagement and higher-order questioning, all of which claim benefits
- assess their combined effectiveness and the extent to which the NLP training might enhance effective pedagogy. Therefore, this research sought to contribute to the debate both about the usefulness of NLP in education and the effectiveness of NLP in general.

Accepting the limitations of prior research into the effectiveness of NLP in education, Carey and colleagues (2011) recommend a large-scale randomised controlled trial to explore the potential of such techniques; this study aims to build on that recommendation. The present study consisted of a research design with three between-subject conditions and a 'within-subject' pre- and post-treatment maths attainment test.

The conditions experienced by the three participant groups were:

(1) teachers were given no training between the administration of the pre- and post- test measure (control condition)

(2) teachers were given maths CPD (involving higher amounts of higher-order questioning, challenge, problem-solving and collaborative learning)

(3) teachers were trained in NLP influencing skills in addition to the innovative maths pedagogy training provided for condition (2).

These are described in detail in Appendix 1.

Each adult learner participant group took the same maths attainment test pre- and post-treatment. A review of the literature and subject matter content of NLP training suggested that NLP communication skills were unlikely to improve maths attainment in themselves, if the quality of pedagogy being used was in question (because NLP communication skills are essentially content-free). Rather there was more likely to be a measurable effect if a baseline of good pedagogy was established and known to be in place.

Hypotheses

The study's design therefore allowed for the testing of two hypotheses:

- Hypothesis (a) – adult learners whose teachers are trained in innovative maths pedagogy attain higher maths results than adult learners whose teachers have had no training.
- Hypothesis (b) – training teachers in NLP influencing skills enhances the maths attainment of adult learners whose teachers have trained in innovative maths pedagogy.

Participants

In the light of the arguments above and the controversial nature of NLP, we adopted the most stringent quantitative approach to researching this topic that was possible within the timescales and budget.

Determining the sample size

Drawing on best practice, we undertook a power analysis prior to participant recruitment[1] in order to estimate a minimum sample size for the trial. Results indicated a recommended sample size of >207. Anticipating substantial levels of participant attrition (drop-out) because of the transient nature of adult numeracy classes, the recruitment approach aimed for a target number of 300–350. Recruitment was via email and presentations at networking events, and targeted the teachers of adult numeracy learners across the south east of England.

Initial recruitment

Initially, 37 Further Education sector teachers expressed interest in participating in the study. Offender learning (for example prisons and young offender institutions) was not eligible because of data-sharing issues. Of these, 27 teachers began the research (nine in each condition) with 278 adult learners completing the initial baseline testing. A total of 24 teachers (six in the control condition and nine in each of the other conditions) completed the full research cycle.

Participant drop-out

As anticipated, there were substantial levels of participant attrition during the study as well as the loss of three teachers from the control condition. In addition (to reduce the risk of 'ceiling effects' in the final testing phases – when variance in an independent variable cannot be measured or estimated above a certain level), the decision was taken to remove learners who scored more than 95% in the initial pre-treatment maths test. Six learners whose scores were above this cut-off point were withdrawn from the participant group following the baseline test. These participants had, or had nearly, achieved a maximum in the initial baseline testing because they were probably in the wrong maths groups in their college/organisation.

The final sample

In total, 173 adult learners between the ages of 16 and 71[2] completed the post-treatment maths test:

- no training, n = 43
- training in innovative maths pedagogy, n = 67
- training in NLP and innovative maths pedagogy, n = 63.

This represented six control-condition individual teacher groups, nine maths pedagogy alone groups and nine NLP and maths groups. See Table 1.

[1] This used G*Power 3.1.2 (Faul et al., 2007; 2009).
[2] Mean age = 30.94; Standard deviation = 13.12.

Table 1: Adult learner participants who completed the research study

Conditions	Number of participants	Mean age	Age range	Standard deviation	Males	Females
No training	43	37.79	16–68	13.44	11	32
Innovative maths pedagogy	67	27.09	16–71	12.37	18	49
NLP and innovative maths pedagogy	63	23.44	16–51	10.61	41	22
Total	173	30.94	16–71	13.12	71	102

As an incentive, teachers whose classes completed the research could attend a post-research conference and additional training. There were no incentives for the adult learners. All participants received treatment that was in accordance with standard ethical research guidelines.

Materials used in the research

All adult learner participants received the same pencil and paper single-level maths test that they completed pre- and post-treatment. Participants also completed a demographic questionnaire (i.e. relating to age, gender). The maths test was from the Department for Education and Skills ReadWritePlus Skills for Life Diagnostic tools in Numeracy Testing. The test covered curriculum areas as specified in the Skills for Life Adult Core Curriculum for Numeracy: Entry 1, 2, 3 and Levels 1 to 3 (DfES, 2001).

The research process

Before the administration of the pre-treatment test and demographic questionnaire, we randomly allocated teachers to one of the three conditions described above whilst controlling for a number of background factors to ensure a similar distribution in each condition. The controlled variables were: teacher qualification level; number of years in teaching; spread of experience in teaching Skills for Life Numeracy, Functional Maths and Key Skills – Application of Number. No teachers from the same organisation/location completed the same condition to avoid the risk of 'content sharing' in relation to the training received and 'contamination' between participant groups.

Addressing criticisms of NLP within the research design

One criticism of NLP is that it is a form of 'cargo cult' psychology (Roderique-Davies, 2009). The implication being that any effects are perceptual (or placebo) and exist only in the minds of converts – although no research has tested this hypothesis yet. In response to this criticism, the present study implemented a number of additional controls. All the adult learners were kept 'blind' to the purpose of the study and to the content that their teachers had, or had not, been trained in – the teachers simply adapted their practice without making any explicit references to anything that they had learned.

In relation to the teachers, the no-training group remained 'blind' to the content that the other teacher groups had been trained in and the innovative maths pedagogy alone group remained unaware of the content of the training given to the NLP and innovative maths group. Furthermore, the NLP-trained teachers did not know that they were to receive training in NLP until they arrived on the first day of the NLP training programme. All other participants remained unaware that NLP was part of the research design. No teachers whose learners completed the study had received any previous training in NLP.

The adult learners gave consent before completing the pre-treatment maths test, attitudes questionnaire and demographic questionnaire. Teachers conducted the pre- and post-treatment maths attainment tests in their own classrooms in FE or sixth-form colleges, work-based learning providers and adult and community learning providers. There was no time limit for the test. Learners could take as much time as they needed to attempt (in one session within one lesson) as many questions as possible before handing in the test paper. Pre-treatment tests took place in the middle to end of the autumn term and post-treatment tests at the end of the spring term or beginning of the summer term (a six months' time period), although exact control of this variable was difficult because of the nature of adult numeracy learning and differences in weekly contact time and term dates. Where there was variation this was similar within each condition. Teachers themselves received instructions to avoid reading the maths test and simply to invigilate the test on the two occasions, collect it in and post it immediately to the project administrator.

The authors' involvement in the research phase

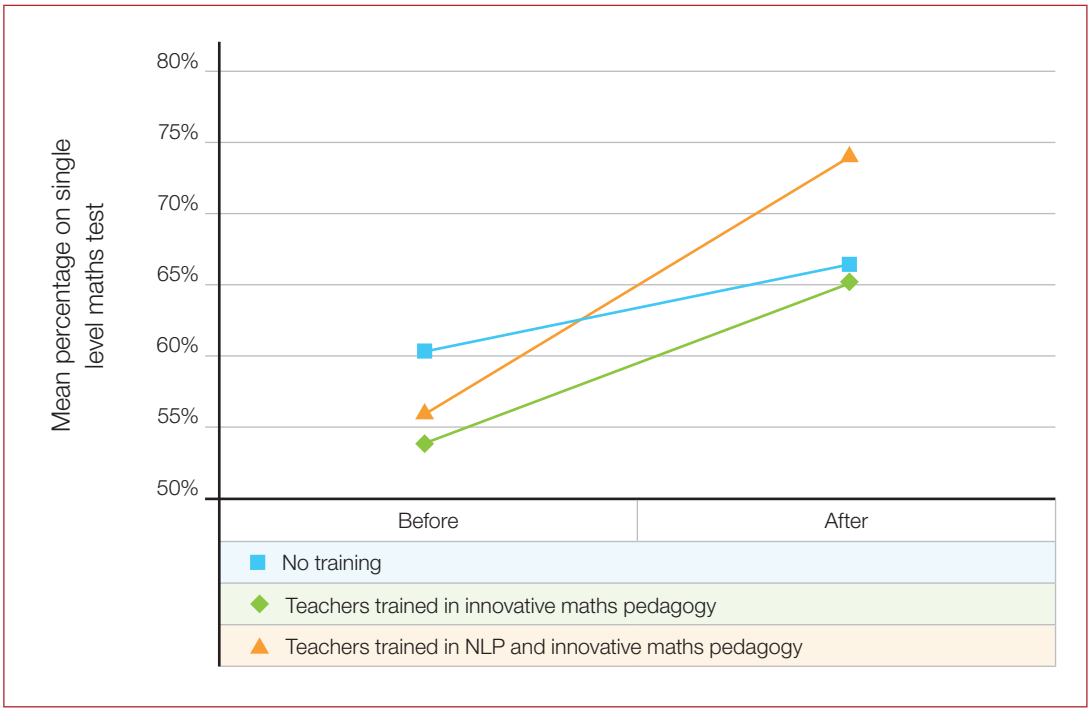
Richard Churches and Fiona Allan delivered the two training protocols (NLP communication skills and maths pedagogy, respectively). Both remained independent of the research process and data until the final report writing stage. Furthermore, they maintained independence from each other during the training delivery phase and were unaware of the content of each other's training. The CfBT team, led by Joanna Dennison and based at the University of Sussex Innovation Centre, collected and processed the data.

3 Results

Increases in maths attainment

Maths attainment, as measured by the mean percentage score on the single level maths test, increased from 60.37 to 66.05 in the no-training group, from 54.61 to 65.58 for the innovative maths pedagogy group, and from 56.49 to 74.84 for the NLP and innovative maths group (see Figure 1, below).

Figure 1: Maths attainment for the three research conditions



The largest improvement in maths attainment was for the participant group whose teachers trained in both NLP influencing skills and innovative maths pedagogy. Specifically, the NLP and innovative maths pedagogy group had the highest mean increase of the three participant groups (18.35) with an increase in maths attainment that was nearly three times that of the control condition (5.67) and one and a half times that of the innovative maths pedagogy alone group (10.97). Innovative maths pedagogy alone also improved attainment with a mean difference score that was nearly twice that of the control condition.

Assessing whether the changes in attainment were likely to be the result of chance

All three groups improved their mean scores between the first and second test. However, the increase in maths attainment in the group whose teachers had received NLP training was much larger than in the other groups[3]. Specifically, the addition of NLP created an effect size higher than the level considered important by Hattie (2009)[4]. Furthermore, data analysis that can assess whether a change in mean is likely to be repeated at least 95 times out of 100 if the research were to be

[3] no training (p = .003); training in innovative maths pedagogy (p< .0005); training in NLP and innovative maths pedagogy (p< .0005). Effect sizes: d = 0.27, 0.20 and 0.46 respectively.
[4] 0.40.

replicated this amount of times (known as 95% confidence interval data[5]), showed that only the change created by the addition of NLP was likely to achieve this sort of effect. Finally, it was also possible to compare the means for the groups at the start of the research to see if the apparent closing of an attainment gap for the maths pedagogy alone learners had indeed taken place. This showed that the difference in mean between the three conditions at the start of the research was not significant and that therefore, from a quantitative research perspective, they represented essentially the same level of attainment and therefore the same starting point.

Full statistical tests used in the study are described in full in Allan et al. (2013).

Limitations

Because NLP was not trained as a separate condition it is unclear as to the extent to which the improvements in maths attainment were completely due to the NLP training or the result of the combination of NLP and innovative math pedagogy. This said, it seems unlikely that training in content-free communication skills would improve an area of the curriculum like mathematics that has very clear subject and pedagogic requirements without a degree of good practice also being in place. Furthermore, the study did not seek to test whether NLP influencing skills would also improve maths attainment where teaching methods were more traditional, or inconsistent.

A second limitation is that the level of participant attrition reduced the number of participants in the control condition to below that of the other two participant groups and may have affected the results. Specifically, the lack of statistically significant evidence (in *post hoc* tests) that innovative maths pedagogy alone closed a gap in attainment – which in terms of the descriptive statistics appeared to exist between the control and this group – could be the result of this lower sample size for the control condition.

Thirdly, the teachers in the NLP and innovative maths group may have been more motivated to maintain the implementation of strategies during the research period between mentoring visits because they received more training days overall – although discussions with mentors did not suggest that this was the case.

Fourthly, the NLP training contained a number of components that some claim need integration for NLP to be successful as a communication strategy (see Churches and West-Burnham, 2009). This combination of strategies makes it impossible to assess the individual contribution of any of the distinct components.

One further issue may have affected the difference between the control condition and the maths alone group. Many of the maths pedagogy strategies that were included in the training have gradually been implemented across the sector generally, making it difficult to assess the extent to which already existing skills may have confounded differences between the control and innovative maths pedagogy alone conditions.

[5] See graphs in Appendix 2.

4 Conclusions

Training teachers in content-free NLP influencing strategies modelled from hypnosis and family therapy improved maths attainment for adult learners where a baseline of innovative maths pedagogy, involving higher amounts of active learning and group work, was in place. It was not possible to determine conclusively the effectiveness of the particular maths pedagogy used in the study, although there was partial evidence that it had a beneficial effect on its own. It would appear, however, that the addition of teacher communication skills training significantly enhances pedagogy, already established in earlier research.

Based on the evidence from this research, some NLP training has the potential to improve attainment if used as an enhancement to the development of pedagogy and subject knowledge, but not, we would argue, instead of such programmes. Ultimately, from a classroom perspective, the success of any content-free influencing strategy is most likely to depend on the quality of the content communicated (for example the quality of subject knowledge that is so important in maths teaching – see, for example, Burghes (2011)) and appropriateness of learning activities etc. However, this present study suggests that without effective communication, good subject knowledge may not be enough. From a broader perspective, and in relation to the evidence from adult numeracy research, the evidence from this study supports earlier research that shows that engagement and a teacher's ability to create a positive classroom climate is at least as important as pedagogy (see Muijs and Reynolds (2011) for a discussion of the importance of classroom climate generally). What this present study suggests, for the first time, is that some of the interpersonal and intrapersonal skills associated with creating the right conditions for effective adult numeracy may be able to be modelled, codified and transferred to and between teachers.

In relation to criticisms of NLP generally (Heap, 1988; 2008; Roderique-Davies, 2009), we believe that the effect sizes in this study are preliminary evidence that some NLP techniques, when applied to specific contexts, are more than 'cargo cult' psychology (Roderique-Davies, 2009). This conclusion is reinforced by recent statistical research that has yielded confirmatory evidence of the positive effects of NLP in the fields of radiology (reducing the need for anaesthesia in claustrophobic patients undergoing MRI) (Bigley et al., 2010), psychotherapy (Stipancic, 2010) and in relation to high versus low hypnotisables (Kirenskaya et al., 2011). We accept that some of the criticisms aimed at the theoretical foundations of NLP could be valid and agree with writers who suggest a reappraisal of some of the theoretical explanations in the NLP literature (for discussions, see Carey et al., 2010; Tosey and Mathison, 2010). However, it seems increasingly likely (as the evidence from this study suggests) that the issue in relation to some areas of NLP is one of poor theory rather than effectiveness.

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Appendix 1: The research conditions in detail

The three conditions experienced by the three research groups are described in detail below:

(1) No training

Adult learners in this group completed the maths attainment test at the beginning of the allocated time period and again at the end. Their teachers received no training (from the project) between the two testing points.

(2) Training in innovative maths pedagogy (involving greater amounts of higher-order questioning, challenge, problem-solving and collaborative learning)

Adult learners in this group completed the maths attainment test at the beginning of the allocated time period. Their teachers received two days of training in innovative maths pedagogy.
The principles of effective adult numeracy teaching, as defined in the National Centre for Excellence in the Teaching of Mathematics 2008 report (NCETM, 2008) (and which define a more innovative approach to pedagogy in adult learning) formed the basis for the curriculum, with a particular emphasis on higher-order questioning:

- building on existing knowledge
- exposing misconceptions
- using higher-order questioning
- using appropriate whole-class, individual and small group work
- encouraging reasoning rather than 'answer-getting'
- using rich collaborative tasks
- creating connections between topics, both within maths and with the real world
- using technology appropriately
- confronting difficulties rather than avoiding them
- developing mathematical language
- understanding what has been learned and how.

The training the teachers received also built on ideas and approaches from the Maths4Life project (see Carpentieri et al. (2010) for a summary). Teachers in Condition (2) were encouraged to use the online adult numeracy resources available at the Learning and Skills Improvement Service's Excellence Gateway throughout the research period. Participants also received non-NLP-related mentoring support to help them to embed the training that they had received. This mentoring was carried out by the same individuals who mentored group 3 (see below), all of whom were trained to NLP Diploma level but in the case of group 2 were briefed to avoid using any NLP-related techniques. At the end of the allocated time period, the adult learners completed the same single-level maths test again.

(3) NLP and innovative maths pedagogy group

Adult learners in this group completed the maths attainment test at the beginning of the allocated time period. Their teachers received the same innovative maths pedagogy training as Condition (2) above. The teachers also received a further four days of training in NLP. The NLP training curriculum consisted of:

- learning to use influential language patterns modelled from hypnosis (the Milton model (Grinder and Bandler, 1975b; 1981)), in order to formulate positive suggestions in relation to attainment, motivation and behaviour (Churches and Terry, 2007). Specifically, the teachers were taught how to create positive presuppositions and suggestions and how to use: cause and effect and complex equivalence patterns, chained modal operators, double binds, embedded commands, linkage language, pacing and leading, universal quantifiers, yes set and yes tags. Language pattern cards illustrating the approaches above are available from the authors (the particular cards were co-designed with the teachers as part of the training review process).

- learning to understand the effects of Satir body language categories (Blamer, Placater, Leveller, Computer, Confuser) and apply appropriate categories in a congruent way (Bandler and Grinder, 1976; Bandler et al., 1976) whilst communicating in the classroom (Churches and Terry, 2007). This component of the training included foundation training in the development of sensory acuity and the use of matching and mirroring to build rapport (Bandler and Grinder, 1979).

- learning to use anchoring to support emotional state management (Bandler and Grinder, 1979) whilst teaching using spatial anchoring (Churches and Terry, 2007).

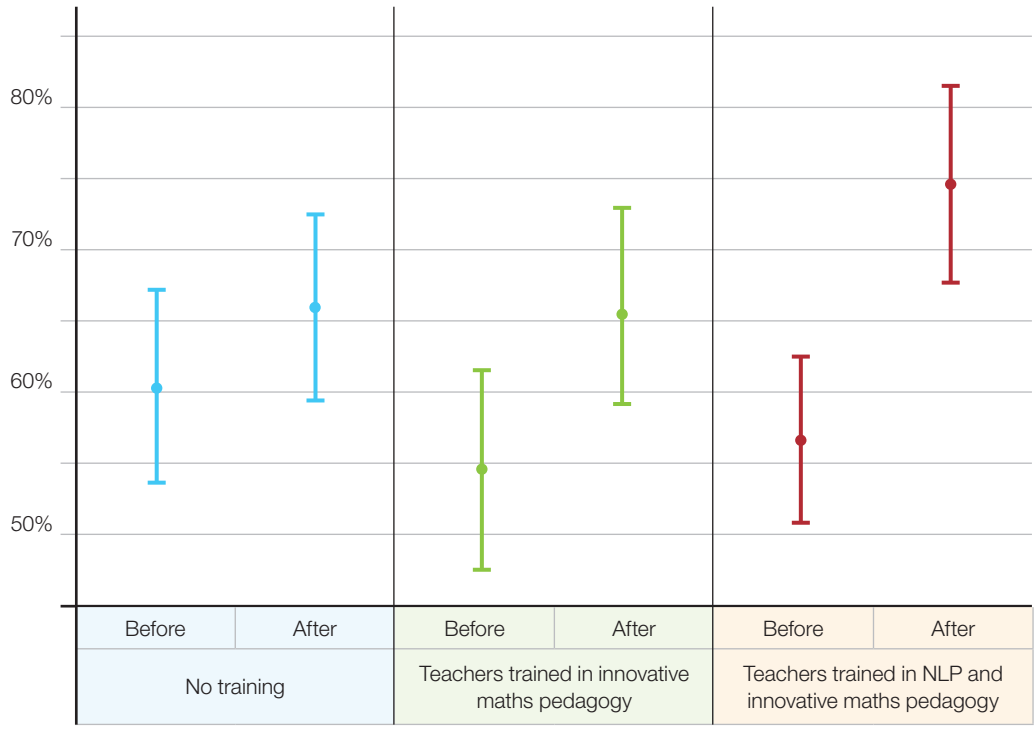
At the end of the allocated time (six months), the adult learners completed the same single-level maths test again.

Teachers in Condition (3) received additional NLP reading material (Churches and Terry, 2007; Terry and Churches, 2009) and the Teaching Influence cards used in previous NLP classroom case study research (Carey et al., 2010; 2011). They also received mentoring support from mentors trained to INLPTA NLP Diploma level (INLPTA, 2005) to help them to embed the training they had received. Roger and Emily Terry of Evolution Training delivered the INLPTA training to mentors.

Appendix 2: 95% confidence intervals for the three conditions

The confidence interval shows where a mean is likely to fall in 95 out of 100 repeated studies. If there is a gap between the intervals before and after a research intervention, this means that researchers can be confident of the findings.

95% confidence intervals around the pre- and post-treatment mean maths attainment scores for the three conditions



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PMS: 6360 06/13 ISBN: 978-1-909437-23-4