

A STUDY OF EFFECTIVE PRACTICE IN INCLUSIVE ADULT NUMERACY TEACHING

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This paper reports on one of a suite of projects on adult basic education, combining analysis of quantitative and qualitative data. Adult numeracy teaching was observed in a wide range of settings and involved diverse groups of learners and teachers. Classes made a significant overall mean gain of 9% in attainment, but the range of gains between classes was large. Few correlations between gains in learning or attitude and characteristics of teaching, teachers or learners were found to be significant. This connects with the awareness expressed by teachers of the need to be flexible and adapt their approach to circumstances.

INTRODUCTION

This paper describes the findings of a 33 month correlational study into effective practice in adult numeracy classes. The design was based on a US study of the teaching of literacy and English language to adult learners for whom English is an additional language (Condelli *et al.*, 2003). It was one of a suite of five NRDC studies in reading, writing, ESOL and ICT based at three different centres. The research team included four university researchers and six teacher-researchers.

The study aimed to investigate a range of naturally occurring variations in teaching numeracy to adult learners in different settings, to measure the correlations between different teaching practices and learners' progress, and to make recommendations for teaching, teacher training and continuing professional development (CPD). The study was set within the context of the government's *Skills for Life* strategy to improve adult literacy and numeracy in England (DfEE, 2001). In *Skills for Life* numeracy is defined as the ability 'to use mathematics at a level necessary to function at work and in society in general' (DfEE, 1999, p 2).

RESEARCH DESIGN

The data were collected in two Phases in the academic years 2003/4 and 2004/5. Forty-seven classes were recruited, 17 in Phase 1 and 30 in Phase 2. Thirty classes were in FE colleges, 4 in adult or neighbourhood colleges, 2 in family numeracy, 4 in workplaces, 2 Jobcentre Plus, 1 Army training course, 2 in prisons and 1 private training provider. These were mainly clustered around in the North-West and West of England and in the London area. A total of 412 learners in 47 classes, with 34 teachers, participated in the study. Thirty-three teachers and 112 learners were interviewed and 113 classroom observations were carried out; approximately 2 per class in Phase 1 and 3 per class in Phase 2.

Learners were assessed near the beginning and end of their course using a test of 20 items selected from the national *Skills for Life* survey (DfES, 2003); these ranged in demand from Entry level 1 to Level 2. They also completed a background information survey and an initial and final attitude survey, which included statements relating to usefulness, enjoyment and difficulty of learning numeracy. Teacher background data was also collected during the interview.

FINDINGS

Learners

Of the 412 learners, 36% were of British origin, 31% Asian, 6% Caribbean and 6% African. 59% had English as their first language. 20% had attended other maths/numeracy classes since school, 40% had a previous maths/numeracy qualification, 9% had had numeracy training at work and 23% reported at least one factor affecting ability to learn, with dyslexia occurring most frequently (7%). More than half the sample were female (54%, n=222) and 41% (n=169) were 16-19 year olds.

The main reasons they gave for taking a numeracy course were: to get a qualification (58%), get a better job (43%), prove something to themselves (37%), help them become more confident (37%), help children with homework (20%) and help with everyday things outside the classroom (20%). 40% of the learners said that they enjoyed their overall experience of school, whilst 40% did not. 20% said that they liked maths at school, 60% did not. Learners preferred adult numeracy classes to school, with 90% expressing satisfaction. 52% enjoyed maths now, whilst 32% did not.

Teachers

Of the 34 teachers, 25 (74%) were women and 9 (26%) were men. Teachers had been teaching maths or numeracy for 13 years on average, teaching adults for 8 years and teaching at their current institution for 6 years. Almost three-quarters (74%) had experience of teaching to GCSE level, 25% at A-level. 56% had previously taught in secondary schools, and 24% in primary schools. 77% had experience of teaching 16-19 year olds and 88% of teaching over 19 year olds. 79% reported having some qualification in maths or a numerate subject, 88% had a teaching qualification and 18% had attained the new level 4 qualification in adult teaching.

Teachers said that teaching adults was difficult because of the wide range of ability and needs of learners, individuals with 'spikey profiles', the problems of motivating younger groups doing key skills as part of other courses, and the constant movement of students in employment courses and prisons. They said that to be effective teachers of adults needed to be flexible, plan well, and have a variety of approaches. They aimed to help learners articulate what they understand and make connections between different areas of numeracy. The variety of practice, both between and within different teachers, was justified in relation to specific circumstances. Some teachers preferred to move from whole group to individual work; some had a group activity in the middle of long sessions; some tried hard to get social interaction by finding

common tasks even though learners were working at a range of levels; some favoured having learners separately engaged with an appropriate activity.

Classroom characteristics

Classroom characteristics derived from the lesson observations were grouped under seven headings: structure and organisation, teachers' role, teaching process, learners and learning, teacher-learner relations, materials, and mathematical pedagogy.

The most common methods of class organisation were to teach the class as a whole group or have individuals working on their own. Overall, very little group work was found. Hardly any teachers used any practical apparatus, games, computers or calculators. While worksheets were used extensively, few teachers used textbooks. Resources were judged to have supported and enhanced learning in the majority of sessions.

The great majority of teachers were observed to be enthusiastic. They gave both praise and encouragement to their learners, they gave feedback on work and they monitored learning as it was taking place. Most teachers used direct teaching, and the majority were able to flexibly respond to learners' needs. Most teachers demonstrated adequate subject knowledge, gave clear explanations, broke work down into smaller steps and worked through examples. The majority used a range of activities. In about half the sessions observed, teachers were seen differentiating work, and/or making connections to other areas of mathematics, and/or asking higher order questions.

Learners were engaged in their learning for the majority of the time and were generally given time by the teachers to gain and develop understanding. Learners seemed challenged and stretched, and/or had their individual needs addressed, in about half of the sessions. There was great deal of mutual respect between teachers and learners and most learners felt free to express themselves. Teachers shared the overall goals of the lesson with the learners in about half of the sessions.

Learning gains

Mean class gains ranged from -13.3% to 32.5% with an average gain of 9%. On average, nearly 8% more learners were successful on each item at the end than at the start of their course.

Level	Entry 1	Entry 2	Entry 3	Level 1	Level 2	Total
Number of items	4	4	4	4	4	20
Mean success Time 1	89.3	79.5	60.3	31.8	23.8	56.9
Mean success Time 2	92.4	83.5	66.2	43.8	36.6	64.4
Mean Gain	3.1	4.0	5.9	12.0	12.8	7.6

Table 1: Number of items in each level with mean success rates at Time 1 and Time 2 and mean gains per item

As the difficulty level of the question increased, so the gains made increased ($n=20$, Spearman's $\rho = 0.87$). One reason for small gains in the Entry level 1 and 2 items is the high proportion of learners that answered them correctly in the first assessment, so there was little room for progress in these items. The other reason for the higher gains in Levels 1 and 2 items is that 18 groups were aiming at Levels 1 and/or 2, and just 10 were aiming only at Entry or Pre-Entry levels (the remainder were mixed). But there was no significant correlation between gains made by learners and their initial scores.

A one-way ANOVA was carried out first in order to investigate if any learner characteristics were related to amount of progress made. The following variables were examined: gender, age group, first language, ethnic group, having attended another numeracy class since school, reporting a factor affecting learning and formal qualifications held. The only statistically significant difference found was that learners who reported not already holding a formal qualification in maths made greater progress ($p=0.05$). There was no significant correlation between the age participants left school/full-time education and the magnitude of the gain in scores between Time 1 and Time 2 ($\rho = -0.04$). The only motivational reason for learners attending the course, which was significantly correlated with gain, was 'to become more confident' ($p<0.05$). The reason 'to get a better job' was close to significance ($p=0.06$). There was no correlation between the gain made and the hours for which learners attended.

Out of all the characteristics of teaching observed, the only significant positive correlation with mean class gains was with the amount of procedural teaching ($\rho=0.45$, $p<0.01$). There were two significant negative correlations, with the amount of individual work ($\rho = -0.34$, $p=0.02$) and, perhaps surprisingly, with the use of appropriate resources to enhance learning ($\rho=0.32$, $p=0.03$).

Other correlations

Teachers were classified according to their teaching approach. Three typologies were identified: the *connectionist* and *transmission* styles (Askew et al., 1997), and the *constructivist/scaffolder* style, after Bruner and Vygotsky (Wood, Bruner and Ross, 1976; Vygotsky, 1993). We also looked at the extent to which the approach was *open* or *closed*. There were no correlations between gains made and the balance of the teaching style across typologies (*transmission/ connectionist/constructivist*), or with the degree to which lessons were *open* or *closed*.

Effect sizes

We then examined the five highest performing classes in greater depth to find out whether any particular features distinguished the teaching in these classes from the sample as a whole. We calculated the effect size for classroom characteristics. Table 2 shows the characteristics that showed significantly differences between the five top-performing classes and the average ($p=0.05$).

<i>Characteristics observed to a greater(+) or lesser(-) extent in the top 5 classes</i>	<i>Effect Size</i>
Whole class teaching	+1.06
Use of whiteboard	+0.90
Use of interactive board	+0.88
Use of plenary	+0.87
Teacher engages in direct teaching	+0.82
Teacher sets up practical activities	-0.78
Teacher links maths to previous work	+0.76
Mathematical pedagogy: procedural	+0.72

Table2: Classroom characteristics significantly differentiating high performing classes from others ($p=0.05$)

However there were also positive effect sizes over + 0.5 for the five *lowest* performing classes for the extent of whole class teaching and use of whiteboards.

Attitudes

Learners over 20 years of age and learners of non-British origin had slightly but significantly more positive attitudes at the start of the course; however by the end of the course learners of British origin caught up. Mean attitude scores increased by a very small but statistically significant margin of 2%. Difficulty was the only subscale where there was a significant but small improvement. There was no significant correlation between either attitude or change in attitude, and gain.

SUMMARY AND CONCLUSION

Adult numeracy classes have a huge variety of learners and take place in very diverse settings. This made it difficult to find an instrument to sensitively assess progress.

Adult learners are generally highly satisfied with their course and their teachers are generally experienced and well qualified. Overall classes progressed significantly over the study period, although there was a wide range of mean gains. However there were few relationships between observed characteristics of teaching and teaching and gains in learning or attitude. This suggests that the gains may be generally more dependant on characteristics of learners and classes, especially those we could not easily measure, than on those of teachers and the style of teaching used.

Adult numeracy teachers appear to adapt their approaches to the different types of setting and learner needs, and recognised that flexibility was a key to effective teaching. The results suggest that there is every reason to encourage this flexibility and little reason to recommend any specific approach or organisation.

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