

# A 'positive' approach to supporting a pupil with Down syndrome during 'dedicated numeracy time'?

**Ruth Germain**

School of Education, University of Birmingham, UK

**Abstract** - This exploratory study has been designed to consider how mainstream staff can most effectively support pupils with Down syndrome in numeracy. The study is partly based on the work of Wishart (1996, 2001), looking at motivation and learning styles in young children with Down syndrome. An individual case study was carried out during 'dedicated numeracy time', a central part of the National Numeracy Strategy framework, in a reception class. Background information was collected from the educational records of the pupil, initial unstructured observations and semi-structured interviews with the class teacher and Learning Support Assistant. Structured observations were carried out across individual, group and whole class settings. The findings, from this single case study, revealed that, contrary to the expectations of staff, the pupil demonstrated less inappropriate behaviour in the whole class setting, in comparison to individual and group settings. However, the pupil was more successful in his independent attempts at tasks in individual and group settings, in comparison with the whole class setting. The report concludes that it is important to provide pupils with appropriate support to avoid failure, particularly during the early stages of learning. It also recommends that the pupil is able to work within the mainstream classroom and participate, with the appropriate support, in the whole class 'mental maths' session and plenary on a more regular basis. This is a small-scale study and the findings tentative. It does however indicate the need for further research in this area.

**Key Words:** Down syndrome, numeracy, learning style, adult support, behaviour

## Introduction

*Providing a maximally supporting learning environment is obviously critical for children with Down syndrome.* (Wishart, 2002, p. 18)

The number of children with Down syndrome being taught in mainstream schools has continued to expand over the last 10 years. Alton (1998) emphasises the need for teachers to understand the "learning profile typical of children with Down syndrome, thus paving the way to successful inclusion" (p. 167). It is important that the school prepare themselves, as every child with Down syndrome is different and has their own, potentially unique learning needs.

## Dedicated numeracy time

*The daily maths lesson is appropriate for almost all pupils. You should aim to ensure that everyone makes progress and gains positively from the lesson...* (Department for Education and Employment, 1999, p. 21)

The 'dedicated numeracy time', as part of the National Numeracy Strategy was introduced to schools in Septem-

ber, 1999. A typical lesson is designed to begin with mental calculation and oral work. This is followed by the main teaching activity. The lesson is concluded with a plenary session where key concepts are highlighted. Within this framework, Hughes (1999) shows how pupils will spend half or more of the time engaged in whole-class work. This structure raises questions for mainstream teachers who have pupils with moderate/severe learning difficulties in their class. The DfEE (1999) maintain that pupils will benefit from "the emphasis on oral and mental work and participating in watching and listening to other children demonstrating and explaining their methods" (p. 23). Despite this reasoning, Briggs (2000) still questions whether pupils with learning difficulties are going to be adequately catered for within this seemingly tightly 'prescriptive approach'. Careful thought and planning will be needed to ensure that work is appropriately differentiated. Opportunities need to be provided for all pupils, including those with learning difficulties, to contribute in all three parts of the lesson.

## Numeracy and pupils with Down syndrome

*Until recently there has been limited interest in the attainments of children with Down syndrome in relation to numeracy.* (Porter, 1999, p.85)

The main focus of educational research into Down syndrome has been on pupils and their acquisition of literacy skills. Over the last 20 years there has been an increase of interest in this area. Findings from studies, despite many still being in their early stages, have shown that most children with Down syndrome are able to achieve a useful level of literacy ability (See Buckley, 2001).

This growing body of knowledge and the realisation of what pupils can achieve has led to an increase in numeracy studies. Although attitudes are beginning to change, Lorenz (1998a) shows that the currently available evidence does suggest that "all students with Down syndrome experience significant difficulties in acquiring a working knowledge of mathematics" (p. 56). Despite this, Caycho *et al.* (1991) show that pupils with Down syndrome develop counting concepts in the same way as their peers. However, Gelman and Cohen (1988) suggest that this may not be so, and Wishart (2002) proposes that the process of general cognitive development, not just in relation to mathematical learning, is fundamentally different in children with Down syndrome. On the evidence of Caycho *et al.*, it would appear therefore, that there must be other explanations for the difficulties being experienced. Lorenz (1998a) suggests that these are due to the same factors affecting other areas of learning. The most notable ones include the acquisition of abstract concepts and language skills. Alton (1998) explains how language development is very specific to Down syndrome, and pupils are therefore likely to experience difficulty. The delay in developing mathematical concepts may therefore be accounted for by the 'mathematical language' needed to acquire the numerical skills. Difficulties in these areas can present problems in mathematical thinking and unless addressed, may restrict the pupil's level of achievement. Alton (1998) emphasises the need to differentiate the curriculum for children with Down syndrome. This may be done through the use of a range of teaching methods and resources, classroom organisation and/or providing additional adult support.

## Learning styles and cognitive development of pupils with Down syndrome

*From a very early age, it is evident that many avoid opportunities for learning new skills and make poor use of those skills that they do acquire...* (Wishart, 1996, p. 199)

Children with Down syndrome will experience some difficulties in their learning. The presence of the extra copy of chromosome 21 disrupts the developmental processes and causes significant problems in certain areas of learning. Some interesting findings have emerged from a number of longitudinal studies carried out during the last 10 years at Edinburgh University. Wishart (2001) describes how pupils with Down syndrome "preferred to avoid making

errors than to attempt solving a problem which they saw as potentially difficult" (p. 49). She suggests that the learning style of pupils with Down syndrome is characterised by a growing reluctance to take the initiative in learning and an increasing use of avoidance strategies when faced with learning new skills. The response of others to the successes and failures of children with Down syndrome during the pre-school and early school years is likely to influence how they approach learning in later life. Buckley and Bird (1993) make reference to the notion of 'errorless learning', where the child is taught to complete a new task with prompts without being allowed to fail at any stage. Similarly, Duffy and Wishart (1994) advocate the use of errorless teaching strategies as playing an important role in "increasing motivation to learn in children with Down syndrome" (p. 51). These findings have implications for the type of adult support used to facilitate the learning of a pupil with Down syndrome.

Wishart (1996) expresses concern about the 'detrimental learning style' adopted by children with Down syndrome as they get older. It is important to establish how the learning process can be supported to avoid this and help children to maximise their developmental potential. This study focuses on how an individual pupil is supported during the early stages of his numerical development in the placement school.

The case study reported here investigated how an individual pupil with Down syndrome was supported in their learning, during dedicated numeracy time within a mainstream school. The study draws on the work by Wishart (1996, 2001) about avoidant learning styles and cognitive development in young children. She describes some of the strategies young children with Down syndrome use when faced with learning new skills. She examines the extent to which children adopt counterproductive behaviour strategies when presented with opportunities to learn new, more advanced cognitive skills. This study focuses on how learning is organised for a pupil with Down syndrome and how additional adult support is used to facilitate the learning process within dedicated numeracy time. In making some tentative predictions about the outcomes of the study, one would expect that a pupil experiencing individual or group teaching, where it is easier to gauge the work at an appropriate level, would show less counterproductive behaviour. It would be expected that the pupil would demonstrate more counterproductive behaviour in the alternative situation, i.e. in whole class settings where it is more difficult to teach at an individual level.

The limitations of a single case study are recognised. As all pupils with Down syndrome show a wide range of individual differences, it is not possible to make generalisations from a piece of research based on a single pupil. Nevertheless, it is hoped that the findings may raise some issues for mainstream teachers and help in planning how pupils with Down syndrome can be supported in their learning during dedicated numeracy time. This is an illustrative case study

and any suggestions and ideas will need to be adapted according to the needs of individual pupils.

### Background to the study

Paul is four and has Down syndrome. His selection for the study resulted from a personal contact with his Reception class teacher. Paul is currently in a class of 30 children. He receives individual help from a Learning Support Assistant (LSA) for approximately 60% of the class timetable. A group of 12 pupils are regularly withdrawn from both reception classes for Literacy and Numeracy. Paul is included in this group with additional support from the LSA. Background information was collected at the beginning of the study from documentary evidence about the pupil's early educational experience and initial unstructured observations. Semi-structured interviews were carried out with the class teacher and LSA concerning group organisation and how Paul was being supported during dedicated numeracy time. These helped in deciding on the focus of the study before starting the main data collection.

### Method

The research questions of the study were:

- 1) What sort of issues are raised for staff when including a pupil with Down syndrome in dedicated numeracy time?
- 2) How can a pupil with Down syndrome be supported in their learning during dedicated numeracy time?

Eight structured observations, across individual, group and whole class settings were carried out over a 2 month period, in order to answer the research questions. A grid was devised to record the information collected during the observations. The work given to Paul was broken down into 'tasks' in order to look at how he managed each stage of the activity. The recorded information included a description of the task, the pupil response (correct or incorrect), type of adult support and subsequent pupil response (correct or incorrect) and any 'behaviour incidents' (behaviour considered inappropriate by the teacher or LSA). Any behaviour which was responded to in a corrective manner by the teacher or LSA was recorded. Twenty minutes was the maximum amount of time Paul spent working in a whole-class setting during the structured observations. Therefore observations of individual and group activities were limited to the first twenty minutes. Due to the different length of sessions, percentages have been calculated to allow comparisons to be made across individual, group and whole class settings. The

observational findings were analysed alongside the results from the semi-structured interviews. The navigational metaphor of 'triangulation' is used by Ackroyd and Hughes (1992) to describe this multi method approach. Triangulation can help the researcher to avoid the danger of drawing false conclusions from a single viewpoint. Robson (1993) shows how "it improves the quality of the data and in consequence the accuracy of findings" (p. 383). Documentary evidence, observations and interviews were used in this case study to help in validating the results.

### Results

The results from the interviews highlighted that Paul's behaviour was a concern for the class teacher and LSA. Both commented on the benefits of the small group as this helped Paul in turn taking and learning to work alongside other pupils.

The main findings from the structured observations can be seen in Table 1. There were fewer incidents of inappropriate behaviour during the whole class sessions, with, on average, only one behaviour incident occurring during a whole class session. This is in comparison to six incidents, on average, during the first 20 minutes of the individual sessions and five incidents for group sessions.

Data was collected on how Paul was supported - this included whether he was given an opportunity to respond to the task unaided; the success of his initial responses (his first independent attempt to carry out a task); and the types of adult support given by the adult. The types of support were categorised under the following headings:

- tasks using physical prompts;
- shared tasks (teacher or LSA working with Paul in order to complete a task without physical support);
- tasks where visual clues were given (these included the use of flash cards, cubes, number lines, plastic numbers, Makaton signs)

Table 2 shows that Paul was often given no opportunity to make an independent attempt at tasks, particularly in

| Context     | Length of session (mins.) | Total number of behaviour incidents | Number of incidents during first 20 minutes | Average number of incidents in first 20 minutes |
|-------------|---------------------------|-------------------------------------|---|---|
| Individual  | 40                        | 23                                  | 6   | 18/3 = 6  |
|             | 60                        | 21                                  | 9   |   |
|             | 45                        | 9                                   | 3   |   |
| Group       | 60                        | 22                                  | 4   | 15/3 = 5  |
|             | 60                        | 23                                  | 6   |   |
|             | 60                        | 13                                  | 5   |   |
| Whole class | 20                        | 0                                   | 0   | 2/2 = 1   |
|             | 20                        | 2                                   | 2   |   |

Table 1: Organisation and behaviour

| Context     | Average % of tasks with no opportunity for an initial response | Average % of tasks with an opportunity for an initial response | Average % of tasks with initial response correct |
|-------------|--|--|--|
| Individual  | 37   | 63   | 40   |
| Group       | 52   | 48   | 32   |
| Whole class | 89   | 11   | 4  |

**Table 2: Timing of adult support**

whole class settings (89% of tasks). This may be due to the perceived level of difficulty of the task by the teacher/LSA. Paul was given more opportunities to make an initial attempt at the task without adult support during individual (63%) and group sessions (48%). Brown (1998) explains how "small group work and some individual tuition and monitoring enable the children to work at their own rate, responding to the challenge of appropriate targets" (p. 41).

It is easier for a teacher to set tasks at the appropriate level for a pupil receiving individual tuition. Berger, Morris and Portman (2000) emphasise that care must be taken to find the right level of challenge for each child. Pupils will find ways to 'opt out' of opportunities to learn, if tasks are frequently too hard (Wishart, 2002). Conversely, tasks which are too easy can make pupils lose interest and confirm their 'low view' of their mathematical ability. It is important that work is planned to be at the right level for the pupil.

Table 3 shows the high success rate for tasks with adult support during individual (98%) and group (96%) settings. The average percentage of tasks completed successfully during whole class settings was much lower (45%). These results also indicate that no matter which situation the teaching is taking place in, visual cues may ensure suc-

| Context     | Average % of tasks successfully completed with adult support | Average % of tasks successfully completed with physical prompt | Average % of tasks successfully completed shared tasks | Average % of tasks successfully completed with visual clues |
|-------------|--|--|--|---|
| Individual  | 98   | 100  | 97   | 100   |
| Group       | 96   | 97   | 94   | 100   |
| Whole class | 45   | 83   | 27   | 100   |

**Table 3: Task success and type of adult support**

cess in task completion. Paul was praised by the LSA and class teacher on successful completion of a task. Fox (1998) explains how "children often have low self-esteem and perceive themselves as failures, so take every opportunity to give praise and build confidence" (p. 45).

It is important, particularly during the early stages of learning, to use strategies to maximise the success rate of pupils with learning difficulties.

## Discussion

The main issue raised by both the class teacher and LSA concerned group organisation, particularly in relation to Paul's behaviour. The unpredictable nature of his behaviour was given as being the main reason for his withdrawal from

the whole class for dedicated numeracy time. For example, the LSA explained how although Paul's behaviour had improved since the beginning of the year she still felt that the small group was more beneficial. She said, "It is harder in the classroom. Paul seems to conform more in the small group".

Similarly, the interview with the class teacher showed how she found it easier to teach and manage the rest of the children when Paul was 'withdrawn' from the classroom. In contrast to this, the observations of Paul's behaviour suggest that this should not be the main reason for his withdrawal. It may be possible to investigate this further and, if appropriate, allow Paul more opportunity to work alongside his mainstream peers within his own classroom for all or part of the dedicated numeracy time.

Some examples of the types of behaviour Paul was exhibiting during individual and group sessions included throwing resources on the floor, getting out of his seat and running around the classroom and objecting to having to write. The observations showed that Paul demonstrated inappropriate behaviour most often when the LSA was helping his peers. This may have been due to a lack of concentration or lack of adult attention. Some inappropriate behaviour was also

seen when Paul was given tasks which were too hard. For example, Paul appeared to find it difficult to grasp the concept of 'before' and 'after' during an activity using cubes and objected to giving the cubes back to the LSA at the end. These observations suggest that Paul might be "adopting counterproductive behav-

our strategies when faced with opportunities to learn new, more advanced cognitive skills" (Wishart, 1996, p. 173). If so, it is important to consider how Paul can be supported in his learning to help to avoid this, particularly as acquiring mathematical vocabulary is one of the main emphases of the National Numeracy Strategy (DfEE, 1999).

The findings relating to Paul's behaviour for whole class situations are a reversal of the earlier predictions, i.e. a pupil would show less counterproductive behaviour during individual or group teaching than whole class, and are therefore somewhat surprising. Due to the small-scale nature of the study it may be that the observed behaviour is not typical of

his behaviour in the whole class. The limitations of the study are recognised. This needs to be investigated over a longer period of time and the results compared with the findings of this research. The issue of behaviour is not unique to the case study school. A contribution on the Senco-forum, an electronic mailing discussion list, when talking about some pupils with Down syndrome described "behaviour that causes teachers enormous difficulty and prevents learning", Senco-forum (2002), as a real barrier to inclusion. It is recognised that training is necessary for staff to know how to support pupils in an appropriate manner and enable them to learn alongside their mainstream peers.

Initial response success results show that Paul was more successful on his initial responses in individual and group work than in the whole class setting. These results and the comments made by the class teacher indicate that it is more difficult to provide the appropriate level of work for Paul in the whole class setting. For example, "the gap between Paul and the lowest group in the classroom would be wide and getting wider".

Nevertheless, Lorenz (1998b) encourages teachers to include pupils with learning difficulties in whole-class teaching. If work is differentiated appropriately this can have a very positive effect on the pupil. Smith (1999) suggests that the plenary session can be used to celebrate the success of all pupils. This can help to raise confidence and self-esteem. It may be possible for Paul to be included in the whole-class activities within the dedicated numeracy time, with the appropriate support, to allow him opportunity to learn with his typically developing peers. Although it is important that pupils do not experience failure, over-reliance on adult support may also prove detrimental. Wishart (2002) shows how children with Down syndrome may "rely on the help of other people, even when it is not needed" (p. 23) and be unwilling to take initiative in solving problems themselves. The class teacher and LSA need to plan tasks carefully to ensure that the appropriate level of support is provided according to the needs of the individual child.

Results for task success depending on type of support revealed that Paul is less successful during whole class sessions. Although further investigation is needed, it may be that other kinds of support could be used. The DfEE (2000) guidelines and video for supporting pupils with special educational needs in the literacy hour, show how a pupil with Down syndrome is included in the whole class teaching session. The guidelines describe some of the ways in which additional adult support can be used effectively. For example, aiming to increase the pupil's inclusion in their peer group, rather than isolating him or her and building up their independence rather than encouraging dependence. Careful preparation and planning is needed to ensure that staff are clear about the learning objectives and their own role in helping pupils to achieve them. It may be possible to adopt some of these guidelines for dedicated numeracy time and provide Paul with more opportunity to learn successfully, alongside his mainstream peers.

The case study shows that Paul is experiencing a high success rate with adult support. Buckley and Bird (1993), as discussed earlier, advocate the notion of 'errorless learning'. They explain, from their studies of reading, how pupils with Down syndrome find it difficult to correct wrong responses. They suggest that it is important to prevent wrong guesses using prompts to guide the child through the task. The adult support can gradually fade until the child can do the task without help. The use of visual clues led to 100% of tasks being completed successfully across all settings. As visual clues require the least amount of adult support (in comparison to physical prompts and sharing the task), it is recommended that these be used more frequently (see also Bird & Buckley, 2001). Further discussion of the effect of the different types of support, i.e. physical, shared tasks and visual clues can be found in Germain (2001).

## Conclusion

The findings from this small-scale case study are outlined below. They have been used to make some comments about supporting a pupil with Down syndrome during dedicated numeracy time.

- Paul demonstrated less inappropriate behaviour in the whole class setting, compared to individual or group settings
- Paul was more successful in his independent attempts at tasks in individual and group settings
- Paul experienced a high success rate for tasks with adult support during individual and group teaching sessions

It is recognised that these findings pose a dilemma for staff in mainstream schools. Although Paul demonstrated less inappropriate behaviour in the whole class setting, he was more successful in his learning in individual and group situations. This illustrative case study has highlighted some of the practical issues currently being faced by teachers and support staff. It is important to recognise that children with Down syndrome will experience difficulties in attaining academic milestones. If failure is to be avoided, schools must take seriously the task of providing appropriate support. Wishart (1996) highlights how some of these difficulties can be reduced by "paying much more attention to how they go about the task of learning and by looking more closely at the contexts we provide for that learning" (p. 198). It may be possible, with careful planning, to increase the amount of time Paul can spend with the rest of his class. Paul could begin the session with his peers for 'mental maths', continue to have individual/group teaching for the main part of the lesson and rejoin his class for the plenary. It is vital that the kind of support provided is appropriate for the individual child. It is important to avoid failure, particularly during the early stages of learning and praise each step of progress, however small it may be. In this way, teachers can help to ensure that pupils with Down syndrome have a 'positive' experience of numeracy. This area is under researched and further studies are needed to look more closely at behaviour and the kind of sup-

port needed to maximise the learning of individual pupils during dedicated numeracy time.

## Acknowledgements

I would like to thank Dr. Jill Porter for her guidance and support during this study. I also wish to thank the staff at the case study school for their willingness to participate in this research. This study was carried out as part of a M.Ed. course in Special Education (Learning Difficulties) at the University of Birmingham.

## Correspondence

Ruth Germain • School of Education, University of Birmingham, Edgbaston, Birmingham, B15 2TT • Email: reg144@bham.ac.uk

## References

- Ackroyd, S. & Hughes, J. (1992). *Data Collection in Context*. Essex: Longman.
- Alton, S. (1998). Differentiation not discrimination: delivering the curriculum for children with Down syndrome in mainstream schools. *Support for Learning*, 13(4), 167-73.
- Berger, A., Morris, D. & Portman, J. (2000). *Implementing the National Numeracy Strategy for Pupils with Learning Difficulties-Access to the Daily Mathematics Lesson*. London: David Fulton.
- Bird, G. & Buckley, S. (2001). *Number Skills Development for Children with Down Syndrome (5-11 years)*. Portsmouth, UK: Down Syndrome Educational Trust.
- Briggs, M. (2000). Feel free and flexible. *Special Children*, 125, pull-out supplement, 1-8.
- Brown, B. (1992). Providing for special educational needs within the primary curriculum. In K. Jones & T. Charlton (Eds.) *Learning Difficulties in Primary Classrooms* (pp.41-58). London: Routledge.
- Buckley, S. (2001) *Reading and Writing for Individuals with Down Syndrome - An Overview*. Portsmouth, UK: Down Syndrome Educational Trust.
- Buckley, S. & Bird, G. (1993). Teaching children with Down syndrome to read. *Down Syndrome: Research and Practice*, 1(1), 34-39.
- Caycho, L. , Gunn, P. & Siegal, M. (1991). Counting by children with Down syndrome. *American Journal on Mental Retardation*, 95(5), 575-83.
- Department for Education and Employment (1999). *The National Numeracy Strategy: Framework for Teaching Mathematics from Reception to Year 6*. London: DfEE.
- Department for Education and Employment (2000). *The National Literacy Strategy: Supporting Pupils with Special Educational Needs in the Literacy Hour*. London: DfEE.
- Duffy, L. & Wishart, J. (1994). The stability and transferability of errorless learning in children with Down syndrome. *Down Syndrome: Research and Practice*, 2(2), 51-58.
- Fox, G. (1998). *A Handbook for Learning Support Assistants*. London: David Fulton.
- Gelman, R. & Cohen, M. (1988). Qualitative differences in the way Down syndrome and normal children solve a novel counting problem. In L. Nadel (Ed.) *The Psychobiology of Down's Syndrome* (pp51-99). Cambridge, MA: MIT Press.
- Germain, R. (2001). Access to numeracy: a case study. *British Journal of Special Education*, 28(4), 182-186.
- Hughes, M. (1999). The national numeracy strategy: are we getting it right? *The Psychology of Education Review*, 23(2), 3-7.
- Lorenz, S. (1998a). *Children with Down Syndrome. A Guide for Teachers and Learning Support Assistants in Mainstream Primary and Secondary Schools*. London: David Fulton.
- Lorenz, S. (1998b). *Effective In-class Support. The Management of Support Staff in Mainstream and Special Schools*. London: David Fulton.
- Porter, J. (1999). Learning to count: a difficult task? *Down Syndrome Research and Practice*. 6 (2), 85-94.
- Robson, C. (1993). *Real World Research*. Oxford: Blackwell.
- Senco-forum (2002). Special Educational Needs: Discussion Groups: Senco-forum Mailing List Archives <http://forum.ngfl.gov.uk> [Accessed: 2002, April]
- Smith, G. (1999). Will the numeracy hour add up? *Special*, Spring, 8-11.
- Wishart, J. (1996). Avoidant learning styles and cognitive development in young children. In B. Stratford & P. Gunn (Eds.) *New Approaches to Down Syndrome* (pp. 173-205). London: Cassell.
- Wishart, J. (2001). Motivation and learning styles in young children with Down syndrome. *Down Syndrome Research and Practice*, 7(2), 47-51.
- Wishart, J. (2002). Learning in young children with Down syndrome: public perceptions, empirical evidence. In M. Cuskelly, A. Jobling & S. Buckley (Eds.) *Down Syndrome Across the Lifespan* (pp.18-27). London: Whurr Publishers.