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Title: Comparing five interventions for struggling readers in Ireland: Findings from four years of action research

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Comparing five interventions for struggling readers in Ireland: Findings from four years of action research

Comparing 5 reading interventions

Key words: reading, literacy, evidence-based practice, intervention

Abstract

This paper summarises findings from 4 years of action research projects. The Waterford Reading Projects aimed to introduce a variety of evidence-based literacy interventions for struggling readers to local primary and secondary schools and to evaluate outcomes, using action research methods. Participants were 200 students in the age range 5 to 17 years and had average reading scores at approximately the 13th percentile at pre-intervention. There were ultimately 5 Projects. Each project involved learning support teachers delivering an evidence-based intervention over a specified time frame (3 months) and collecting pre and post-intervention data. In reporting on the findings, this paper summarises the evidence base for five particular interventions: Acceleread/ Accelewrite, Peer reading, Toe by Toe, SNIP and ARROW. Furthermore, the outcomes for 200 students using these five different intervention programmes are compared and discussed.

Introduction

This paper summarises findings from a 4 year study (from 2006-2010) organised by the local National Educational Psychological Service (NEPS) in Waterford, Ireland. The Waterford Reading Projects aimed to introduce a variety of evidence-based literacy interventions for struggling readers to local primary and secondary schools and to evaluate outcomes, using action research methods. There were ultimately 5 separate projects, each involving learning support teachers delivering an evidence-based intervention over a specified time frame (3 months) and collecting pre and post-intervention data.

Literature Review

What do we Know about Teaching Children to Read?

The synthesis of research findings reported here, draws on a number of meta-analysis and research synthesis studies, completed within the last 12 years. Specifically, Swanson and Hoskyn (1998), Vaughn, Gersten and Chard (2000), the Report of The National Reading Panel (NRP, 2000), Scammaca, Vaughn, Roberts, Wanzek and Torgesen (2007), Slavin, Cheung, Groff and Lake (2008) Brooks (2007) and Singleton (2009). Information from meta-analyses and best evidence syntheses is supplemented by recent individual studies, demonstrating the effectiveness of particular approaches in the UK. Therefore, information from the work of Solity and his colleagues (reported in Solity 2000 and Solity, Deavers, Kerfoot, Crane and Cannon 2000) and the work of McKay (2006) also were considered. See Nugent (2010, in press) for a full discussion about this literature.

In summary, the following approaches have been found to be effective:

- Structured, systematic teaching (NRP 2000, Swanson and Hoskyn 1998, Singleton 2009)
- Small group settings (not more than 3) or individualised teaching are best (Vaughn et al 2000, Swanson & Hoskyn 1998, Scammaca et al 2007)
- Teachers need to be well trained and have on-going professional development (NRP 2000, Slavin et al 2008)
- Cooperative learning, including peer reading approaches can be highly effective (particularly with adolescents) (Brooks 2007, Slavin et al 2008, Vaughn et al 2000)
- Teaching should be daily or almost daily, with practice distributed rather than massed (Solity 2000, Scammaca et al 2007)
- Students need to be taught new skills to the point of fluency (NRP 2000, Solity et al 2000)
- Task difficulty should be managed to give students high levels of success (Vaughn et al 2000)
- Intensive interventions of relatively short duration can be highly effective and interventions of longer duration do not necessarily produce better outcomes (Brooks 2007, Vaughn et al 2000, Singleton 2009)
- On-going assessment of student achievement and early identification of difficulties (Solity et al 2000, Scammaca et al 2007)
- Computer assisted learning has considerable potential, but needs to be carefully matched to student need (Brooks 2007, NRP 2000)
- Encouraging children to make positive declarations about their future achievement can be helpful (MacKay 2006)

Evidence-Based Interventions and Measuring Progress- What is Possible ?

There is an increasing emphasis on evidence based interventions: interventions where there is research evidence to support the efficacy of the approach (see Brooks 2007, Scammaca et al 2007, Slavin et al 2008, Singleton 2009). Brooks sets out various methods of measuring progress in reading and sets a standard by which literacy interventions for failing readers can be measured. One way of measuring progress is by using ratio gains: a calculation of the rate of progress over the time of the intervention. Particularly helpful, is the guidance for interpreting ratio gains. Brooks (2007) suggests that ratio gains of more than 2 are the standard to which to aspire, as '*many schemes now produce impacts of this order or more*' (p30). In effect, Brooks argues, *'Good impact- sufficient to at least double the standard rate of progress- can be achieved and it is reasonable to expect it'*. (p32).

Programmes that Help Struggling Readers

In the Waterford Reading Projects, the psychology team presented up-to-date research evidence about named intervention programmes or approaches, so that teachers had an evidence based menu from which they could select a programme.

In order to make this manageable and accessible, a limited number of programmes were presented. They were largely programmes that were readily available in Ireland. However, teachers were also made aware of other

interventions, which required additional training or funding or large scale organisation (such as Reading Recovery, ARROW, and Phono-Graphix). One of the developments that happened over the course of the projects was that when schools were made aware of the potential of the ARROW programme, a number of schools invested in that programme, which was, at that time, entirely new in Ireland. Ultimately five interventions were chosen by the vast majority (87%) of teacher participants:

- Acceleread/ Accelewrite (Clifford and Miles 1994)
- Peer Reading (see Topping 2000 for a discussion)
- Toe by Toe (Cowling & Cowling 1993)
- SNIP (a precision teaching package, see Binder and Watkins (1990) and Smart & Smart, undated)
- ARROW (ARROW 2008).

Other interventions were either not selected (often due to a lack of available training) or selected by very small numbers (and therefore did not provide adequate data for comparison purposes).

As these interventions may not be familiar to the reader, a brief summary of each, with information about the evidence base, is included here. Much of the data reported below is drawn from Brooks, (2007) *What Works for Pupils with Literacy Difficulties* (2007). This substantial text compares 48 schemes used in the UK. However, this information is supplemented by additional research (some of it unpublished) carried out in Ireland and the UK.

Acceleread/ Accelewrite

Accelread/ Accelewrite is a computer based programme, developed by Clifford and Miles (1994). It uses 'talking' word processors, and involves students reading text, memorising sentences, typing in the text and listening to the computer 'read back' what they have written. Students can self-correct errors. It is a highly structured programme and the recommended protocol is for individual tuition for 20 minutes, 5 days per week for 4 weeks.

Research reported by Brooks (2007) based on the Jersey Project, involved 61 students in 15 primary schools and 4 secondary schools. After 4 weeks of intervention, students made ratio gains of 8.3 in reading, with further increases reported over time. Brooks also reported on the Bristol study, which involved 60 children in 13 primary schools. After 8 weeks of intervention students made ratio gains of 2.3 in reading accuracy and 2.9 in comprehension.

Irish research, involving 13 pupils aged 11 to 13 years, who received between 11 and 17 sessions of Acceleread/ Accelewrite found that they made average gains of in 12 months progress reading and 7 months progress in comprehension (Tierney, 2005). Furthermore, a small-scale study by Devenney (2007) showed the potential for class teachers to deliver Acceleread/ Accelewrite, while continuing to teach the mainstream class group. Seven participants in this study, who completed a four week block of intervention, working on a computer within the classroom, under the supervision of the class teacher, made 9 months progress (progress of 5

standard score points) in reading, while a control group (those attending learning support) made no measurable progress.

Peer Reading

Peer reading, almost certainly familiar to readers, is largely based on the work of Keith Topping and colleagues. Broadly speaking, those who need help with reading are matched with a non-professional who assists by reading to the learner, reading alongside the learner and then listening to the learner read in a graduated system of support. Procedures for correcting errors and giving frequent praise are specified. In this project, the peer reading generally involved children reading with peers in school. Peer reading is reportedly cost-effective in terms of teacher time, but needs on-going organisation, including the training if tutors, monitoring of progress, maintenance of the programme (for example monitoring attendance and trouble-shooting incompatible pairings). Logistical issues of time, space and suitable reading materials also need consideration.

Peer reading is one of the most comprehensively researched interventions available. Brooks (2007) reports on studies involving 2,372 children in 155 projects in 71 schools. Ratio gains of 3.3 in reading and 4.3 in comprehension were reports (effect sizes were .87 and .77 respectively). As Topping (2000) noted, the general picture in published studies is that peer readers progress about 4.2 times ‘normal’ rates in reading accuracy, during the initial period of commitment. Further research in Ireland found that this approach was also

effective with students with a mild general learning disability. In this study of cross-aged peer tutoring, data was collected for 30 ‘helpers’ and 18 ‘learners’, attending a special school. Those involved in peer tutoring made twice as much progress as control groups, with ‘helpers’ making 15 months progress in reading, while a control group made 7 months progress and ‘learners’ made 7 months progress, while a control group made 3 months progress (see Nugent, 2001). In a further study, Nugent and Devenny (2008) reported on a peer reading scheme in a secondary school in Ireland. Consistent with other findings, it was found that helpers make the most significant progress, making twice as much progress in reading over the course of the intervention, than did a comparison group.

Toe by Toe

Toe by Toe is a highly structured programme that teachings phonic skills. The reading of non-words is a feature of this programme, and there is considerable emphasis on recording progress. It is suitable for children from the age of 6 years and has been used effectively in the prison service. It is an individualised approach and the recommended protocol is for 20 minutes of instruction, daily.

Published research includes a study of 24 secondary aged pupils. There were matched pairs in the control group (normal learning support) and the experimental group (Toe by Toe, taught individually, for 20 minutes per day, five days per week, for an average of 3 months). The results were reported in Literacy Today in 2004:

'*The results were definitive. The experimental group made average gains of three and a half years. The control group made average gains of five months.'* (McKay and Cowling (2004).

Furthermore, MacKay (2006) used the Toe by Toe intervention with 91 children who struggled with reading in 32 Scottish primary schools (part of the West Dunbartonshire Reading Initiative). After 6-7 months of intervention, the average participant made gains of 14 months in reading (representing a ratio gain of 2.3). Finally, Brooks (2007) reported on an unpublished study by Keith Taylor, which found that 21 participants in a primary school made gains of almost 4 years in reading, over an 18 month period of intervention (ratio gains are reported to be 2.7).

SNIP

SNIP is perhaps the least well-known of the intervention methods described here. It is grounded in the theory of precision teaching and instructional psychology and was developed by Carol and Phil Smart. It is suitable for children in the upper part of primary school or early secondary school and aims to develop their sight vocabulary, particularly of essential curriculum words. Students are taught lists of sight words, which they practice daily, for five minutes, until they attain fluency. SNIP was attractive to the psychologists organising this research because it was freely available to download! The evidence-base for it as an intervention was relatively poor. On their website, the authors claimed, '*Using this pack we have achieved measurable gains of*

three years in an academic year with some of our pupils' (Smart and Smart). Although this claim does not constitute reliable evidence, nonetheless the efficacy of precision teaching methods is well-documented (See Binder and Watkins 1990).

ARROW

ARROW stands for Aural- Read- Respond- Oral- Write. It is a programme developed by Colin Lane (2008). It works on the principle that hearing one's own voice is a psychological key to much language comprehension. The system involves children recording and playing back their own voices reading, using laptop computers and headphones and a structured system of examples and exercises. The program displays a piece of text at the appropriate level (anything from a single letter to a short paragraph). The child hears it spoken, then repeats it aloud, and records it, then plays it back. At the end of the process, the child writes down the piece of text. The programme has a range of protocols, typically 30 minutes per day, for a total of 10 hours tuition. One adult is able to supervise a number of children (typically 5), as long as each child has access to a computer.

Brooks (2007) evaluated a large range of literacy interventions and, in relation to ARROW he noted, '*The ratio gains show that this amount of progress…was remarkable, if not spectacular'* (p133). In the study cited by Brooks, 91 children made average gains of 7 months in reading and 6 months in spelling after just 1.5 week's of intervention.

Lane also reported on further data (2008) involving 445 children in 20 schools. Typically, after 2-3 hours of ARROW training, children made average gains of 9.5 months in reading age. Those who undertook longer programmes (8 to 10 hours of ARROW tuition) made gains of 14 months in reading age.

Methodology

The Four Studies

This report amalgamates data from five Waterford Reading Projects.

Project 1- 2006-2007, targeted primary aged children

Project 2- 2007-2008, targeted secondary aged children

Project 3-2008-2009, targeted both primary and secondary children

Traveller Project- 2008-2009, an associated initiative, requested by the local Visiting Teacher for Travellers in Waterford, who felt that the Traveller population would benefit from being targeted systematically.

Traveller Project II- 2009-2010 (as above)

Each project involved the following elements:

- A presentation by the NEPS psychologists to learning support about evidence-based approaches and interventions in reading
- Implementation of a range of evidence-based interventions over a period of 3 months
- Completion by teachers of logs to monitor attendance, duration of teaching and learning
- Completion by teachers of qualitative questionnaires

- Collection or pre and post intervention data using a standardised reading test
- A total on 3 meetings for teachers over the course of the 4 months, to set-up, monitor and evaluate the projects

Data were collected about the gains children made in reading using standardised tests. In Project 1, the Nfer Group Reading Test (Nfer-Nelson 1992) was used, using both the sentence completion and (where applicable) context comprehension forms. All subsequent Projects used the Wide Range Achievement Test (WRAT 4, 2006), including word reading and sentence comprehension.

Information about Participants

The total number of participants (students) involved in each intervention is set out below:

Table 1.Number of Participants (students) in each Intervention

Intervention	**Students**
Accelread	43
Peer reading	54
Toe by toe	33
SNIP	21
ARROW	49
Total	**200**

Some schools and some teachers participated in more than one project and a small number of students may also have been involved in more than one project, but since their data was anonymous, it is impossible to be accurate about this. Over the three year, 46 teachers participated in the action research, and data was collected for 221 students. Of these, valid pre and post-intervention data was collected for 200 participants who followed the five most popular interventions.

The age range of participants was from 5 years, 9 months to 17 years, 1 month. The mean age of participants at the start of intervention was 12 years. There were 126 boys and 63 girls participating, with 11 participants for whom gender was unspecified.

Results

Gains in Reading Ability- All Participants

Pre-and Post Intervention Scores

The data presented here, represents pre and post intervention data.
At pre-intervention, students generally were performing below the 13th percentile, with mean word reading standard scores of 81 and mean comprehension standard scores of 83. At post-intervention, the mean standard score for word reading was 85 and for comprehension was 86 (see Table 1). Therefore, the average participant was reading between the 16th and 18th percentile, within the low average range. In Ireland, these students are likely to be discharged from learning support and to have their needs met through mainstream education.

Table 1. Pre-and post intervention standard score test results, all participants

Test	N	Pre-intervention	Post Intervention
Word reading	200	80.6	85.3
Comprehension	188	82.6	86.2

Another way of understanding these results is to transform these standard score results into age equivalents. The GRT II provides such age equivalents scores, but the WRAT 4 provides grade equivalent scores. It is then possible, using a procedure outlined by Shearer Mariotti and Homan (2005), to convert grade equivalent scores into age equivalents. These calculations have, in turn, been used to calculate ratio gains. On the basis of this information, it was found that over the course of a 3 month intervention, the average participant made gains of 12 months in both word reading and in reading comprehension. The average pre-intervention word reading score was 8 years, 3 months, while the post intervention score was 9 years, 3 months. The average pre-intervention comprehension score was 8 years, 9 months, while the average post intervention score was 9 years, 9 months. This represents a ratio gain of 4.

Gains in Reading Ability- Comparing Interventions

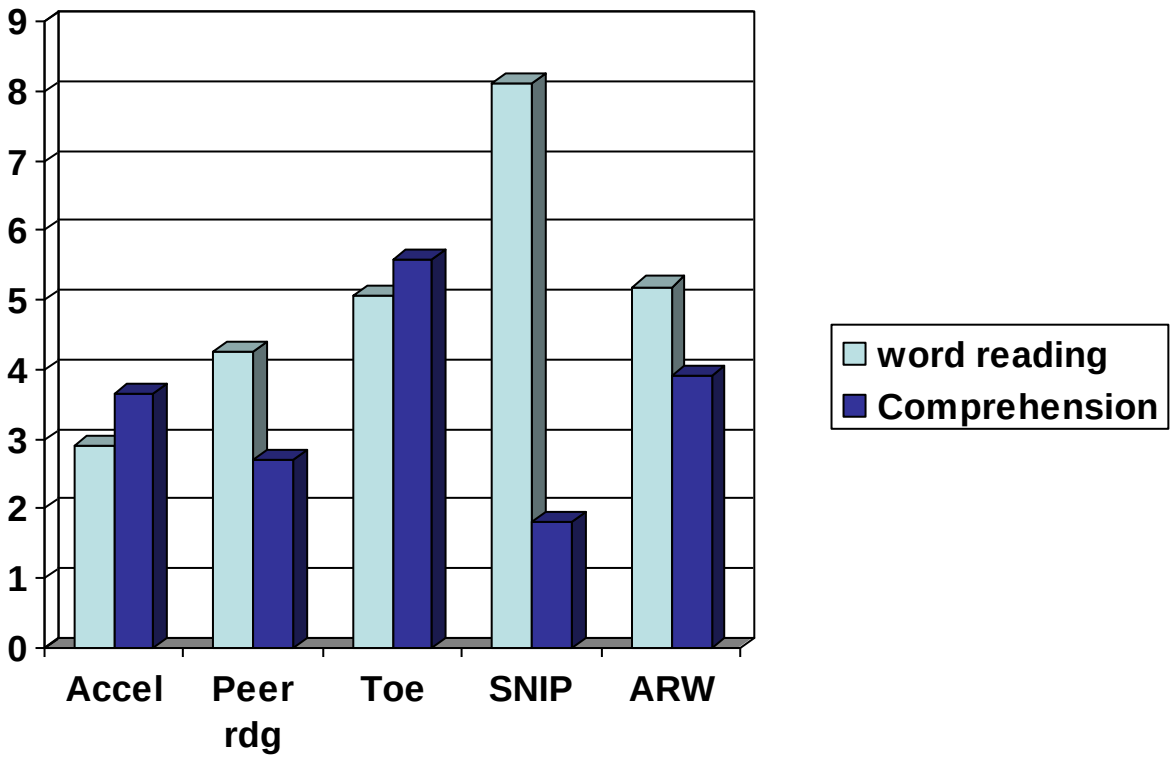
In this section we move from considering the overall progress of participants, to comparing the progress made by participants using five different interventions. Data presented in Table 2, shows the average standard score gains made by participants in word reading and comprehension, in each of five intervention groups.

Table 2. Mean standard score gains in word reading and reading comprehension, by type of intervention, with number of participants.

Intervention	**Acceleread N=43**	**Peer Reading N=54**	**Toe by Toe N=33**	**SNIP N=21**	**ARROW N=49**
Mean gains in word reading	2.91	4.26	5.06	8.09	5.19
Mean gains in comprehension	3.64	2.70	5.58	1.80	3.91

As can be seen from Table 2, those following the SNIP programme made the most progress in word reading, while those following Toe by Toe made the most progress in reading comprehension. Another way of considering this data is to look at standard score gains for each intervention graphically.

Figure 1. Comparison of interventions, based on standard score gains in word reading and comprehension.



What the above data is telling us is complex: It is not the case that any one intervention can be declared the most effective. It appears that SNIP can be a highly effective intervention in the area of word reading, but is less effective in the area of comprehension. This is perhaps not surprising, as this intervention is solely based on word reading tasks. Toe by Toe was impressive, in that it appeared to address both word reading and reading comprehension equally effectively.

Teaching Time and Learning Time

An important consideration in calculating the efficacy of any intervention programme is to look at the amount of time given by students to learning and the amount of teacher time required to deliver the programme. Data was collected about how long each student attended tuition (calculated in hours and minutes) and about how many students were in the teaching group. This data then allowed the researcher to evaluate how much teacher time each student received, (by dividing teacher time by the number in the teaching group), see Table 3. However, it was not possible to estimate teacher time involved in peer reading, as the time involved in was not just contact time, but time spent organising.

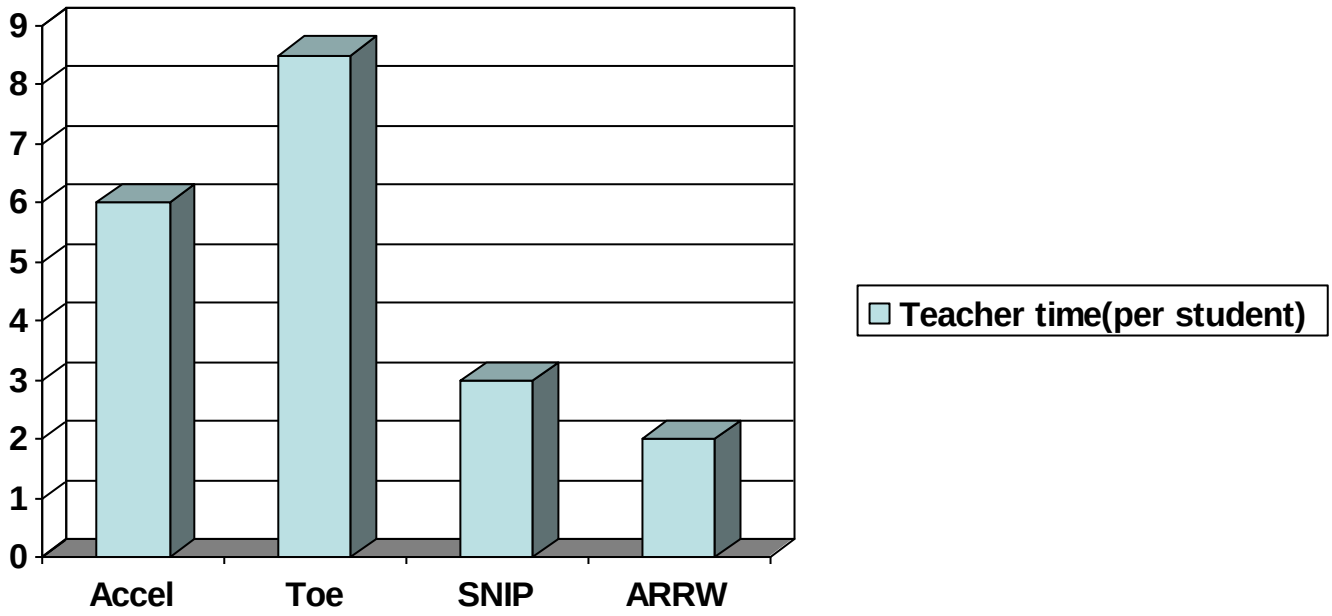
Table 3. Interventions, teaching and learning time per student

Name of Programme	**Total of teacher time, per student***	**Total of learning time, per student**
Acceleread/ Accelewrite N= 43	6 hours	8 hours
Peer Reading N= 54	N/A	13 hours
Toe by Toe N= 33	8.5 hours	10.5 hours
SNIP N= 21	3 hours	6 hours
ARROW N= 49	2 hours	7 hours

* Data is rounded up or down to nearest half hour division

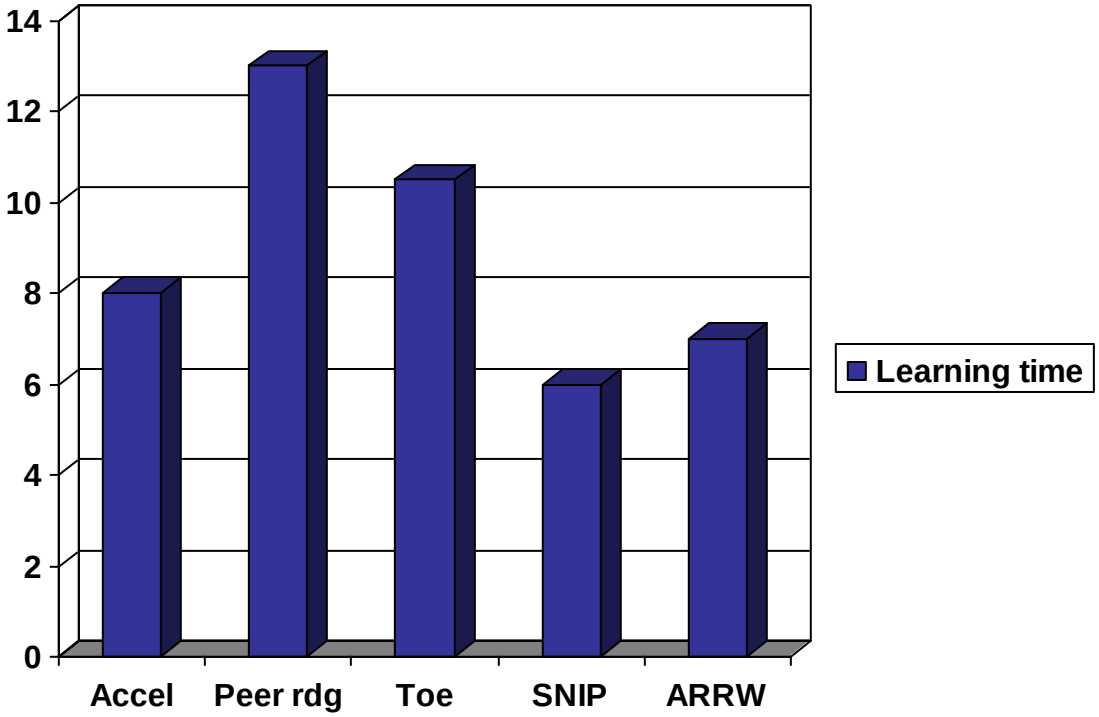
As Table 3 shows, students in Acceleread/ Accelewrite, SNIP and ARROW spent broadly comparable amounts of time learning (between 6 and 8 hours), although those participating in peer reading spent significantly longer (13 hours). More impressive is the value that ARROW and SNIP give in terms of teacher time. The average amount of teacher time used, per student, was 2 hours for ARROW and 3 hours for SNIP. One of the particular advantages of the ARROW programme is that is can be effectively delivered to groups- typically 5 students at a time. The SNIP programme was delivered in both a larger group setting (7 students) and individually, for very short periods of time (10 minutes) making this a very time efficient intervention for both students and teachers. These results are presented graphically in figures 3 and 4, below.

Figure 3. Graph comparing the amount of teacher time spent per student, for each intervention



*Note, teacher time for Paired Reading could not be calculated

Figure 4. Graph comparing the amount of learning time spent, per student, for each intervention



Discussion

Summary of Findings

Five different intervention approaches were trailed with data collected from 200 students. While outcomes were variable, it was not the case that any one intervention could be favoured over others, as some interventions were highly effective in one area (such as word reading) but not in another area (such as reading comprehension). Additionally, when the factors of teacher time and learner time are considered, the picture is again more complex: some interventions were relatively time-efficient because they could be delivered to groups or in very short bursts of time, while others required more one to one teaching. Peer reading required greater learning time, while SNIP and

ARROW were both time-efficient in terms of both teacher time and learner time. On the other hand, Toe by Toe, which required higher levels of teacher time, produced impressive results in both word reading and in reading comprehension. This was less true of both SNIP and Peer Reading, which produced relatively weaker results in the area of reading comprehension, but then these interventions are relatively cost effective.

Systematic Interventions

Feldman (2004) suggests a number of steps which are fundamental to successful interventions, including selecting '*a research-based, validated curriculum as the programme "anchor*"' (p1). Teachers participating in this study choose such a programme anchor and delivered it systematically. (This was monitored through the teaching logs that each teacher completed for each participant, which documented the frequency and duration of teaching sessions and included qualitative notes about student responses). The main element in the success of this project was the commitment and dedication of teachers. Each teacher implemented a structured intervention in a systematic way and monitored outcomes. In a way, what was done was the application of research knowledge to the 'real world' problem of reading failure.

Short-term Intervention

As note in the review of literature, there is evidence that intensive interventions of relatively short duration can be highly effective. For example, Singleton (2009) points out that some data suggests that the rate of progress

may drop off after the first 12 hours of tuition. Topping (2000) suggests that progress in Paired Reading of 4.2 times the normal rate of progress is achieved during the initial period of commitment. The interventions reported above generally did not go beyond 12 hours (those participating in Paired Reading were the only one to spend more than 12 hours on tuition). While the gains reported above are impressive, it does not follow that the same rate of progress could be attained over a longer period of intervention. While average participants made a year's progress in reading over a 3 month period of intervention, it does not follow that participants could make two years progress over 6 months, or indeed, four years progress over one year of tuition. Further, longitudinal studies may be helpful in tracking the rate of progress of students involved in various forms of intervention.

These findings also have implications for teachers when designing their learning support timetables. Short-term, intensive intervention is certainly found to be more effective than longer term, less frequent, intervention. In Ireland, some students selected for learning support, may continue in support for the full academic year, without a formal review of literacy skills. It is suggested here that termly programmes of intervention, with reviews of progress that include formal testing, may be the most appropriate model of support.

One to One or Small Group?

One of the dilemmas for learning support teachers is whether to offer small group tuition (thereby reaching more students) of to offer one to one tuition.

The research suggests that one to one tuition is the ‘gold standard’, but that highly trained teachers using a structured approach can be effective with groups of up to three (Vaughn et al 2000, Swanson & Hoskyn 1998, Scammaca et al 2007). What this study found was that some approaches, such as ARROW, can be used effectively with groups of up to five students, although it remains the case that one of the most consistently effective interventions for both reading and reading comprehension (Toe by Toe) was delivered in a one to one setting. SNIP was interesting because it was effectively delivered both to a group (7 students) and on a one to one basis, and both approaches were effective, although, not surprisingly, the student receiving one to one tuition did best. On the other hand, a programme such as Paired Reading can deliver intervention to relatively large numbers of students. The finding in this study, that Paired Reading was less effective in teaching reading comprehension, is not borne out in other studies, and may be a feature of the students selected (N=54). The one to one versus group tuition dilemma is not straight-forward and is dependent on the programme selected and the students involved.

Word Reading and Comprehension

In selecting an appropriate intervention for a student, teachers need to be aware of the student’s key areas of deficit and select an intervention accordingly. One simple and helpful assessment is discriminating between word reading and reading comprehension. It is suggested here that all struggling readers should be assessed on both measures, so that teachers can identify relative strengths and weaknesses. Data collected here would

suggest that SNIP, Toe by Toe and ARROW may be particularly suitable for those with difficulties with word reading, while SNIP appears unsuited to those with comprehension difficulties.

Selecting an Intervention

The five interventions reviewed here appear to be effective, but there are many other evidence-based interventions available, for example, Phono-Graphix, Reading Recovery and inference training. Brooks (2007) provides a most comprehensive review. Teachers need to select interventions, taking account of a range of factors. The following structure may be helpful in guiding decision making:

- What interventions are readily available to me? (Resources and training)
- Which of these interventions is suited to student's the age group?
- Does the intervention appear to target the student's greatest level of need? (phonological knowledge, word reading, comprehension)
- Are there particular reasons why a student might respond better to one approach rather than another? (Preference for work on computer/ novelty value etc)
- Can the learning support timetable offer the type of structure required by this intervention?

Some new approaches can be implemented at very low cost (SNIP), without any time delay, while other approaches may require longer-term investment and training (ARROW). It is suggested here that teachers aim to build a

repertoire of effective interventions, so that they can be responsive to individual needs. This is not the same as adopting an eclectic approach, where multiple elements of different programmes are combined, which has been found to be less effective. Rather, the teacher systematically delivers an evidence-based intervention and after review, either continues with this programme or offers an alternative evidence-based approach for a further block of time. It is certainly the case that students (and teachers) may tire of particular approaches after an intensive block of intervention, and may be more responsive to novel approach after a period of time.

Conclusion

These action research projects showed that targeted, structured interventions can have a positive impact of the progress of struggling readers, across the primary and secondary age range, even when implemented over a relatively short time. The challenge for teachers is to extend their repertoire of evidence-based interventions, so they can most effectively respond to a diversity of struggling readers.

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