"We tried it and it didn't work." Overcoming barriers to using Precision Teaching with a web based programme.

Abstract.

Precision Teaching (PT) is an evidence based intervention which research indicates is ==frequently not implemented following training, with few teachers using it in schools after training events.== This research, undertaken with 10 schools, explored whether a web-based programme would provide favourable implementation rates and support the fidelity of the programme delivery. The PT programme focuses on word level reading skills and targets blending and segmenting skills rather than whole word reading. The study also measured the impact of the programme on word decoding and sight word reading using the Test of Word Reading Efficiency ==(Torgesen, Wagner & Rashotte, 2012).== Results show favourable implementation rates with 7 of the 10 schools implementing the programme. Full impact data for 34 children show that the programme has a positive impact on decoding (effect size 0.7) and sight word reading skills (effect size 0.6). A timed assessment provides evidence that fluency improved as well as accuracy. Gains were sustained at 2 month follow up.

Key words: Precision Teaching. Implementation rates. Fidelity. Impact. Automaticity. Word Reading.

Introduction.

Precision Teaching has been used to support children's learning extensively for many years (Ward, Crawford & Solity 2017, Boyes & Lyndon 2008, Lindsley, 1991, Raybould 1984, Raybould & Solity 1982). Incorporating key features of instructional psychology it is widely advocated by educational psychologists for use in schools. Despite sometimes being out of favour and having periods of revival it remains something that has consistently been relied on to improve progress in learning (Kessissoglou & Farrell, 1995). It is claimed that 'By its nature, when programme fidelity is maintained, Precision Teaching will impact positively on pupil's progress and provide teachers with critical information on what works'. (Ward, Crawford & Solity, 2017).

PT has been well described in the literature (Ward, Crawford & Solity 2017, Boyes & Lyndon 2008, Lindsley, 1991, Raybould 1984), but for clarity the process is described briefly here. It combines detailed monitoring and analysis of the progress that a child makes with regular distributed practice. PT involves some specific steps;

   1) Pinpoint the skill you want the child to learn.

   2) Explain and teach the skill.

   3) Practise regularly using timed practice tasks – usually of about one minute in duration, gathering results to provide assessment information over time.

   4) Chart the results each time a task is completed.

   5) Analyse the data for rate of change over time.

Implementation rates and barriers to using PT in schools.

As has been noted good implementation following training and good fidelity is not always achieved. Despite extensive resources being available, detailed knowledge about how to implement PT effectively, and convincing evidence of PT's effectiveness, uptake and implementation in schools is low. Just 20-25% of individual staff (teachers and teaching assistants) trained in PT actually go on to use it with children in schools (Killerby 2015).

Sundhu and Kittles (2015) considered the role that a face to face training programme for staff might have on improving the implementation rates of PT. A survey sent to schools following face to face training courses in PT resulted in responses from 5 of 10 schools. It is not known whether the other 5 schools continued to use PT but the authors acknowledge that they may well not have done. Self reported data from 5 schools that responded suggests that PT was being used for a range of different aspects of children's learning and that it was felt to be having a substantial impact. Schools reported using PT three to five times a week, although there was no way to verify this. Barriers to implementing PT were time constraints, staff continuity and negative staff attitudes of those who had not been directly trained by the EPs. Downer (2007) also found that staff attitudes were influential in how children responded to a PT intervention. Having protected time and support from senior staff was seen as paramount as to whether the intervention was a success.

Killerby (2015) demonstrated that a significant predictor of how likely PT would be implemented depended on the individual's perception of how it was valued by others. However Killerby's research also suggests that the barriers to implementing PT are practical rather than attitudinal or intentional. Indeed staff intentions can often be very positive after training, but these intentions do not then get translated into actual implementation. More specifically Killerby found that obstacles to implementation were related to the time and

physical resources that were available to deliver the intervention. It is perhaps not surprising that this is the case given that PT is a very labour intensive system where adults typically are required to set tasks up, develop a sequence of tasks, set aim rates for progress, record the outcomes of regular PT sessions and convert raw data into frequency or celeration charts to use for analysis.

Overcoming barriers to implementation: a web based system for implementing PT.

Ways of overcoming attitudinal barriers to implementing evidence based approaches might rely on effective training, or perhaps also an ongoing relationship between the school and a supporting professional who can support, encourage and enable staff in a school to see the benefits of an intervention, problem solve obstacles or misunderstandings and maintain fidelity. Even when this is in place however the practising EP is often aware of the 'We tried it and it didn't work' plea from schools, and perhaps with some underlying doubt about how well it was tried.

Given that research highlights time and practical aspects of implementing PT as a major barrier to using it in schools a potential solution to overcome some of these obstacles was the development of an online precision teaching programme for schools that completed many tasks for the adults automatically.

The programme is designed to be used on tablets, laptops and computers to support both the implementation and the accessibility of a PT approach with the intention of making it user friendly for both the adult and enjoyable for the child or young person. It provides a detailed sequence of tasks, is able to complete all the recording aspects of the PT method and creates the charts that show children's progress over time.

A broad aspiration was that a web-based programme would help overcome the practical and time related aspects of delivering PT (developing a teaching sequence, keeping paper records, finding the right resources for each session, completing fluency charts). By recording anonymously each task a pupil completes the web-based programme also provides a unique opportunity to get detailed data on implementation fidelity and implementation rates.

Precision Teaching for the word level literacy skills of blending and segmenting.

As has been noted PT methods are used to improve a wide range of skills (Chiesa & Robertson, 2000, Johnson & Street, 2013). The website used in this study was developed with word level reading skills particularly in mind.

Research into PT has invariably taken whole word reading or sight word recognition as the unit of analysis, looking at progress in whole word reading changes over time. (Sharpley & Rowland, 1986, Downer, 2007, Lambe, Murphy & Kelly 2015, Griffin & Murtagh, 2015). Even when phoneme level skills are being taught PT programmes generally still use tasks that require reading whole words to monitor the outcomes of a phoneme level intervention. The web based programme used in this study did not use reading whole words out loud as the tasks the child is tested on. Instead it uses the component skills of blending and segmenting phonemes that are required subskills for word reading in any systematic synthetic phonic programme (Rose, 2006). The programme covers two different versions of blending and segmenting used. Firstly an auditory mode where the adult says sounds and the child blends them to say a word (and vice versa for segmenting) and secondly a visual mode where the child looks at a word and segments it, saying the phonemes (and vice versa for blending).

Web-based precision teaching component.

Schools log into the website securely using an individual log in and password. Each child following the programme has a data record that records each task they complete. The website contains over 40 tasks that contain words of increasing length and phonemic complexity. The content overlaps, or is interleaved, building on previous tasks. It gradually builds from simple three sounds words where sounds are represented by easily recognised graphemes (cat, mop) to more complex polysyllabic words where sounds are represented by rare or infrequently occurring letter patterns (enough, phantom). Each task has to be completed by and adult and a child working together. The sequence of activities includes some 'review' tasks that are made up of nonsense words so that the child is faced with the task of blending and segmenting words that they haven't seen before in text as part of the programme. The programme guide encourages the use of tasks up to three times a day, with mastery being seen when a task is completed three times in a row with 90% success or more.

The research project sought to explore how the use of this web based PT programme might support implementation of PT in schools.

Research questions;

1. Does using a web-based system of implementation lead to favourable implementation rates of PT?

2. What impact does the programme have on children decoding and word reading skills?

The study.

The study comprised two main elements. Schools volunteered to take part in the research project that would run over the whole of one academic year. Schools had access to the web based programme and were able to use it with up to 10 children in their school. Information

about the programme and the research project were shared early in the academic year via web-conferences.

For the first research question data from the website was used to see when schools used the programme with each child. The website records when each task was completed and the outcomes of the task (the number of correct and incorrect items and the time taken). This data was recorded anonymously with a code for each child using the programme. The resulting database gives a detailed picture of how the school are implementing the programme with different children and how often they are using it.

For the second research question schools completed an assessment of decoding and word reading four times. Time 1 marked the start of the project and the baseline. During a one month period between time 1 and time 2 schools were asked to continue to teach and support the children in the usual way in school without starting the programme. Adherence could be verified from website records. The decoding and reading assessments were then repeated at time 2, just before starting the PT programme. The assessments were completed again at time 3, which was at the end of 10 weeks of using the programme. Finally schools completed the assessment again at time 4, which was a 2 month follow up following further normal teaching and support but without using the programme.

Staff using the programme completed a questionnaire that asked them about their experience of using the programme, barriers and and the children's enjoyment of the programme.

Recruitment, attrition and final participant numbers for impact assessment phase.

10 schools around the UK originally started the project. All took part in short web-based training sessions with an educational psychologist. Although only this limited training was provided knowledge of how to use the programme was supported further by staff following

online instructions and reading an online handbook. Of the staff who used the programme in schools 5 reported using PT before and 4 reported not having used it before.

Schools were asked to select pupils who would benefit from an individual intervention for word level intervention. Three schools were unable to complete the interventions because of staff illness or staff changes during the year and one school returned incomplete reading assessments. Of 58 children selected by these 7 schools to use the programme 9 did not complete 80% or more of a 10 week programme.

The final number of pupils completing PT for 10 weeks at an 80% implementation rate or more was 49. Full impact data (completed reading tests) was available for 34 of these (26 male, 8 female, mean age at the start of the research was 8 years and 8 months, SD 2 years 6 months, ranging from 5 years 11 months to 14 years 8 months) from 6 schools around the country (1 Secondary 5 Primary).

INSET TABLE 1 ABOUT HERE.

Fidelity.

Of the pupils who took part in 80% or more of the 10 week programme or more it was possible to see how often they completed tasks. The mean number of tasks completed per pupil was 102. In an 8-10 week programme this meant that generally children completed the tasks twice a day on average, with some as little as once a day and some over three times a day. There was no difference in implementation rates between schools who reported having used PT before and those who were using it for the first time.

Of the 9 staff who completed a short questionnaire 7 reported using the fluency charts generated by the website, 2 reported not using them during the intervention.

Staff perceptions of pupil enjoyment.

Staff using the programme in school were asked to rate to what extent they felt that children using the website enjoyed using the programme on a scale of 1 to 10 with 10 being 'a lot' and 1 being 'not at all'. The mean rating for the 8 ratings completed by staff was 8.2.

Implementation barriers and facilitators.

Staff were also asked to report aspects of the programme they liked or that helped them to implement the PT and aspects that they found difficult or problematic and factors that were barriers to implementing PT.

INSERT TABLE 2 ABOUT HERE.

Impact.

School staff completed assessments of sight word efficiency and phonemic decoding efficiency at baseline (Time 1), immediately before the intervention began (Time 2), immediately after the intervention was completed (Time 3) and two months after the intervention had been completed (Time 4).

Measure of impact on reading skills.

Test of Word Reading Efficiency (Second Edition).

The TOWRE (Torgesen, Wagner & Rashotte, 2012) is standardised measure of single word reading and non-word decoding. The assessment is timed to assess the efficiency with which single words can be read (Sight Word Efficiency) and the process of phonemically de-coding unfamiliar letter combinations (Decoding Efficiency). Four parallel versions provide a way of assessing response to intervention over time.

Results of the impact phase.

Decoding efficiency.

INSERT TABLE 3 ABOUT HERE.

A repeated measures ANOVA was completed to test for within participant effects. There was a significant effect for time [Wilks' Lambda = .012, $F(1,5)=16.6$, $p=0.027$]. Testing for effects of gender and age gave no significant results. T tests for changes at T1-T2, T2-T3 and T3-T4 were completed. Only T2-T3 gave a significant result; $t(33) = 5.56$, $p = 0.00$, r (Cohen's d) = 0.7.

Single word reading efficiency.

INSERT TABLE 4 ABOUT HERE

A repeated measures ANOVA was completed to test for within participant effects. There was a significant effect for time [Wilks' Lambda = .014, $F(1,5)=40.3$, $p=0.008$]. Testing for

effects of gender and age gave no significant results.T tests for changes at T1-T2, T2-T3 and T3-T4 were completed. Only T2-T3 gave a significant result; $t(33) = 4.46$, $p = 0.00$, r (Cohen's d) = 0.6.

Discussion.

Does using a web-based system of implementation lead to favourable implementation rates of PT?

This study has found favourable implementation rates for schools using a web based programme to implement PT. 7 schools out of 10 used the programme and out of a possible 100 children 49 completed a programme of PT that met a minimum criteria of 8 weeks out of a target 10 week programme. These implementation rates are higher than other research that has reported that as few as 25% of staff trained in PT go on to use it with children or that possibly only half of schools taking part in face to face training events go on to use it.

Staff reported that the web based platform brought its own barriers to implementing PT such as occasional difficulty logging into the website and hardware difficulties. Schools reported however that the layout and structure of the programme helped make it simple and easy to use. Other barriers were not related to the fact that it was a web based programme but included general issues such as timetable and time related issues and staff absences.

What impact does the programme have on children decoding and word reading skills?

As a result of following a 10 week PT programme that focussed on blending and segmenting skills (rather than the more commonly used whole word PT tasks) there was an improvement in both decoding skills (effect size 0.7) and sight word reading (effect size 0.6). The TOWRE is a timed assessment task so gains represent improvements in automaticity or efficiency of the skill as well as accuracy. The gains were sustained at 2 month follow up.

Limitations.

The information available about programme implementation and fidelity using this system is markedly better than any which has been reported in previous studies looking at implementation of PT. However there are still some unknowns and although it is possible to see how often a task was completed it is not possible to know exactly what was done it is not possible to know if teachers completed the tasks correctly.

A second limitation is that the TOWRE is standardised on a North American population but is being used for assessing the decoding and reading skills of children in the UK.

Conclusions

A web based programme for implementing PT reduces the tasks that have to be completed by the adult running the programme and has shown implementation rates that are higher than are found when using a standard paper and pencil version of PT. The synthetic phonic approach (Rose 2006) focusing on the skills of blending and segmenting has shown a good level of impact in terms of building both non-word decoding and single word reading skills. The elements of PT completed automatically by the website that would normally have to be completed by the adults running the programme (setting up tasks, sequencing tasks, recording performance, charting performance) mean that many of the barriers reported by previous research (time to implement and the resources needed to implement) have been reduced. It might appear as though a web based system would lead to reduced or inhibited interaction between the child and adult. It is possible that if both people are sat facing the screen then there is a little less interaction than if the adult was using paper and pencil. Some facial cues from the adult might be lost for example, or an expression of frustration or joy might be more easily missed. The impact would be minimal given that the adult and the child have to respond to what the other says and does in the same way as the pencil and paper task.

This research involved schools around the UK implementing an intervention with access to online guidance but with minimal support from the research team meaning that it has a good level of ecological validity.

Although not developed as part of this research project there is also the potential for the anonymised data recorded by the website to be available to educational psychologists who work with the school to support organisational change, coaching and enabling additional work as a result alongside the implementation of the programme in school (e.g. Roberts & Hampton 2008). Through the analysis of individual child level data there is also the potential for long term patterns of how PT is used in schools with different children of different ages to be examined. It is possible that combining this online delivery of PT with face to face training and ongoing support for a school by a psychologist with whom there is good working relationship as a critical friend for the school could result in even higher implementation rates and very strong fidelity for PT, which previous research has found to be elusive.

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Table 1. Attrition data.

	Schools Involved	Pupil participants
Initial number of school recruited.	10	Up to 100
Three schools failed to complete (staff sickness or staff changes).	7	Up to 70
Not all schools used the programme with 10 pupils.	7	58
9 pupils did not complete a sufficient amount of the programme. (80% or at least 8 weeks of a 10 week programme completed with at least the equivalent of one task completed each day)	7	49
Further attrition at impact data level: One school did not complete the reading tests at the required time points. In total 15 individual pupil scores could not be included.	6	34

Table 2. Factors affecting implementation.

Facilitators	Barriers
Clear stages and task progression.	Hardware issues, (buttons were small when using on ipads).
Encouraged an ipsative approach.	Time constraints, Tricky to fit everything in.
Graphs are a great representation of what children are doing.	Difficult to know the correct level to start at.
Giving a dedicated time slot.	Non-standard days, trips, Christmas and timetable in school can make it difficult.
Simple to navigate.	Difficulty logging in to the website.
Easy to access data and helpful in looking at progress.	Staff absence.
The tasks were engaging and quick to do.	Codes rather than pupil names made it tricky.
The progression of the tasks was effective in helping memory for what the children had covered.	

Table 3. Decoding efficiency results, T1 to T4.

	Mean TOWRE standard score.	Standard Deviation.
Time 1 (Start of baseline)	81.4	11.1
Time 2 (End of 1 month baseline – start of intervention.)	81.2	12.4
Time 3 (End of 10-12 weeks of intervention)	86.8	12.7
Time 4 (2 month Follow up.)	88.5	12.7

Table 4. Single word efficiency results, T1 to T4.

	Mean TOWRE standard score.	Standard Deviation.
Time 1 (Start of baseline)	81.2	9.1
Time 2 (End of 1 month baseline – start of intervention.)	81.3	10.2
Time 3 (End of 10 weeks of intervention)	85.4	10.1
Time 4 (2 month Follow up.)	85.6	11.5