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Overcoming barriers to using precision teaching with a web-based programme

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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. The web-based programme in this research focuses on word-level reading skills and targets blending and segmenting skills rather than whole word reading. This research, undertaken with 10 schools, explored whether a web-based PT programme would provide favourable implementation rates, and support the fidelity of the programme delivery. The study also measured the impact of the PT programme on word decoding and sight word reading using the Test of Word Reading Efficiency. Results suggest favourable implementation rates with 7 of the 10 schools implementing the programme. Full impact data for 34 children suggest 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 two-month follow-up.

Introduction
Precision Teaching (PT) has been used extensively for many years to support children’s learning (Ward, Crawford, & Solity, 2017; Boys & 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 less popular, and having periods of revival, PT remains something that has consistently been relied on to improve progress in learning (Kessissoglou & Farrell, 1995; Ward et al., 2017). It is claimed that “By its nature, when programme fidelity is maintained, Precision Teaching will impact positively on pupils’ progress and provide teachers with critical information on what works” (Ward et al., 2017, p. 99).

While PT has been well described in the literature (Boys & Lyndon, 2008; Lindsley, 1991; Raybould, 1984; Ward et al., 2017), for clarity, the process is itemised briefly below. PT combines detailed monitoring and analysis of the progress that a child makes with regular distributed practice. It 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, following training, good implementation and effective 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 factors that might contribute towards low implementation of PT following a face-to-face training course to staff. 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 five schools continued to use PT but the authors acknowledge that they may well not have done. Self-reported data from the five 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. These 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 celleration 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 an allocated professional who can support, encourage and enable school staff to see the benefits of the 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, perhaps with some underlying doubt about how well it was tried.

Given that research highlights that time and practical aspects of implementing PT are major barriers to using it in schools, a potential solution to overcome some of these obstacles was the development of an online PT programme for schools that completed automatically many tasks usually undertaken by the adults.

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, and 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 that a pupil completes, the web-based programme also provides an opportunity to gather 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 over time (Downer, 2007; Griffin & Murtagh, 2015; Lambe, Murphy, & Kelly, 2015; Sharpley & Rowland, 1986). 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 task 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. First, an auditory mode where the adult says sounds and the child blends them to say a word (and vice versa for segmenting) and, second, 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 lists 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 an 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 have not been 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’s 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 were 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). These data were 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 two-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 the children’s enjoyment of the programme.
Recruitment, attrition and final participant numbers for impact assessment phase

10 schools from around the UK 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, five reported using PT before and four reported not having used it before.

Schools were asked to select pupils who would benefit from an individual 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 seven schools to use the programme, 9 children did not complete 80% or more of a 10-week programme (Table 1).

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) were 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 six schools around the country (one Secondary, five Primary).

Table 1. Attrition data.

<table>
<thead>
<tr>
<th>Initial number of school recruited</th>
<th>Schools Involved</th>
<th>Pupil participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Three schools failed to complete (staff sickness or staff changes)</td>
<td>7</td>
<td>Up to 70</td>
</tr>
<tr>
<td>Not all schools used the programme with 10 pupils</td>
<td>7</td>
<td>58</td>
</tr>
<tr>
<td>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)</td>
<td>7</td>
<td>49</td>
</tr>
<tr>
<td>Further attrition at impact data level:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>One school did not complete the reading tests at the required time points.</td>
<td>6</td>
<td>34</td>
</tr>
</tbody>
</table>

Fidelity

Of the pupils who took part in 80% or more of the 10-week programme, it was possible to see how often they completed tasks. The mean number of tasks completed per pupil was 102. In an 8-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, while two 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 eight 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 (Table 2).

Table 2. Factors affecting implementation.

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

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 a 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 (Tables 3 and 4).

Table 3. Decoding efficiency results, T1 to T4.

<table>
<thead>
<tr>
<th>Time</th>
<th>Mean TOWRE standard score</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time 1 (Start of baseline)</td>
<td>81.4</td>
<td>11.1</td>
</tr>
<tr>
<td>Time 2 (End of 1-month baseline – start of intervention.)</td>
<td>81.2</td>
<td>12.4</td>
</tr>
<tr>
<td>Time 3 (End of 10–12 weeks of intervention)</td>
<td>86.8</td>
<td>12.7</td>
</tr>
<tr>
<td>Time 4 (2-month Follow-up.)</td>
<td>88.5</td>
<td>12.7</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Time</th>
<th>Mean TOWRE standard score</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time 1 (Start of baseline)</td>
<td>81.2</td>
<td>9.1</td>
</tr>
<tr>
<td>Time 2 (End of 1-month baseline – start of intervention.)</td>
<td>81.3</td>
<td>10.2</td>
</tr>
<tr>
<td>Time 3 (End of 10 weeks of intervention)</td>
<td>85.4</td>
<td>10.1</td>
</tr>
<tr>
<td>Time 4 (2-month Follow-up.)</td>
<td>85.6</td>
<td>11.5</td>
</tr>
</tbody>
</table>
Results of the impact phase

Decoding efficiency

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

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. Seven 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 eight 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 two-month follow-up.
Limitations

The information available about programme implementation and fidelity using this system is 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, and 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 and implications for practice

This research suggests that 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 positive 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 sitting 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. However, it is argued that 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. Further analysis of this in future research might focus on importance, or not, of the interpersonal aspects of interaction between adult and child.

This research involved schools around the UK implementing an intervention with access to online guidance but with minimal support from the research team, suggesting that it has a positive 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 can then work with the school to support organisational change, offering coaching and enabling additional work as a result, alongside the implementation of the programme in school (for example, Roberts & Hampton, 2008). Through the analysis of individual child-level data there is also the potential for long-term examination of the patterns which emerge of how PT is used in schools with different children of different ages. 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 a 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.
Disclosure statement
No financial interest or benefit has arisen from this research.

References