Investigating the impact of Precision Teaching on aspects of motivation towards literacy learning for male pupils in Year 5 and Year 6.

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Thesis submitted to the University of Nottingham for the degree of Doctor of Applied Educational Psychology

May 2014

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1 Abstract

This thesis project was designed to review the impact of Precision Teaching on elements of motivation and self-efficacy of male pupils in Year 5 and Year 6. Precision Teaching (PT) is a formative assessment based intervention, incorporating the principles of the learning hierarchy (Haring, Lovitt, Eaton, & Hansen, 1978), to deliver individually tailored teaching supported by continuous assessment and feedback. A mixed methods design incorporated single case experimental designs and qualitative interviews with the purpose of exploring the impact of PT on attribution style, locus of control and self-efficacy of pupils. Data was gathered using an adaption of the Multi-dimensional Measure of Children's Perceptions of Control (Connell, 1985), Myself as a Learner (Burden, 1999) and structured interviews with participants. Staff at three schools implemented Precision Teaching with participants following training in this intervention. Results indicate no significant direction of change for internal, powerful others or unknown control over learning for pupils completing PT sessions, with all pupils displaying high internal causal attributions for their learning outcomes. Wider variation in unknown and powerful others control responses during intervention phases indicates that some change may have occurred in pupil perceptions of these elements. Of the four cases described, evidence of increased self-efficacy was found in one case. Analysis of interview data suggested that mechanisms of challenge, feedback of learning changes, and increased competence were potential mechanisms of motivation change initiated by PT. The paper concludes that further research is required to explore these mechanisms with a wider range of participants, and the impact of PT through closer analysis of participant attributions and loci of control over learning outcomes.

Acknowledgements

I would firstly like to thank the Local Authority for their support, specifically the three schools who contributed to this project. I would also like to sincerely thank all the staff who put the intervention into place, and the boys who took part with whom it was such a pleasure to work.

I would like to thank Nick Durbin for his supervision of this research project, and the wider tutor team at The University of Nottingham for their input throughout the doctoral programme. I am also grateful to Edward Raybould for his advice during the project. My thanks also go to the team of TEPs I have trained with for their support and friendship.

I would like to thank my friends and family for cheering me on throughout the doctoral process. Finally to my husband George, for your patience and endless encouragement, thank you.

2 Introduction

Research indicates that those who experience difficulties with literacy are more likely to require special educational needs provision, truant from educational settings, and be excluded (Dugdale & Clark, 2008). They are also more likely to experience negative adult outcomes such as reduced employment opportunities, increased health risks and increased risk of becoming involved in the criminal justice system (Dugdale & Clark, 2008; Gross, Jones, Raby, & Tolfree, 2006).The focus on improving literacy skills has been a subject of much research due to the evidenced link between poor literacy and negative life outcomes (Gross, et al., 2006). “Low literacy skills compromise the ability of the individual to access their rights, participate in civil, social and economic society and ultimately can undermine the community itself. Literacy is therefore not only an issue for the education sector but for all who believe in equality. Everyone in society has a communal as well as personal interest in raising literacy standards” (Douglas, 2009, p. 5). For this reason, the researcher was interested in investigating how literacy needs can be supported particularly for those highlighted to be vulnerable to low achievement in this subject.

Gender differences in literacy attainment have been widely acknowledged (Bradshaw, Ager, Burge, & Wheater, 2010; Richardson, 2012; Tyre, 2006) , with some research studies indicating there are twice as many males exhibiting reading difficulties as females (Flannery, Liederman, Daly, & Schultz, 2000; Rutter, Caspi, Fergusson, Horwood, Goodman, Maughan, 2004) and that lower socio-economic status has a detrimental impact on male pupils’ early reading skills in comparison to females who are equally disadvantaged (Entwisle, Alexander, & Olson, 2007). Current survey data also indicates a persistent gender difference in attitude towards literacy, with boys reading less often and placing less value on literacy than girls (Clark & Burke, 2012; Eccles, Wigfield, Harold, & Blumenfeld, 1993). Research indicates that motivation towards learning influences learning behaviours (Dai & Wang, 2007), with self-efficacy about the task key to predicting how engaged a pupil will be in learning and their subsequent achievement levels (Bong & Skaalvik, 2003). This highly

theorised multifaceted concept incorporates self-perceptions and attributions, social norms and external drivers.

UK reviews of academic progress have provided broad recommendations to improve boys' writing skills and their attitude towards writing, with a key finding being the provision of direct feedback to the pupil on the content and form of his work (Ofsted, 2003). This produced further exploration of the effect of feedback, formative assessment and interventions which used feedback consistently during teaching. Positive affective outcomes of formative assessment have been indicated (Butler, 1987; Miller & Lavin, 2007) with Precision Teaching meeting the definitions of formative assessment (Roberts, 2012; Torrance & Pryor, 2001). Government acknowledgement of the need to support the motivation and attitudes of male learners towards literacy matched the experiences of the researcher when working with male pupils on literacy activities. The researcher therefore developed an interest in promoting affective and motivation outcomes within learning. Limited literacy attainment for male pupils and de-motivated attitude towards literacy was raised as an area of concern within the patch of schools the researcher was working with during her training placement, therefore highlighting this topic to be of specific importance to the locality, in addition to reflecting a UK trend as identified by legislation and research review (Clark & Burke, 2012).

The broad aims of the current study were therefore to explore the effects of an evidence based literacy intervention (Precision Teaching) on motivational style and attributions of young people who were experiencing difficulties with literacy, specifically within the male population who were more likely to hold negative attitudes towards literacy and be vulnerable to lower literacy attainment and motivation. Research questions were formulated to systematically review any changes in motivation through four A-B single case experimental designs. Further exploration of the possible mechanisms of Precision Teaching which may have impacted motivational shift were conducted through interviews with participants.

The first part of this paper (Chapter 3) describes the literature review undertaken to outline the background to literacy, motivation and assessment

through teaching which are fundamental underpinnings of the current study. The subsequent systematic literature search outlines the current research exploring the impact of Precision Teaching on motivation, and outlines the potential for this paper to contribute to the evidence base for this intervention.

Chapter 4 outlines the mixed methodology used to investigate the research questions in this study, alongside the epistemological considerations of the researcher. This chapter also reviews the reliability and validity strengths and weaknesses of the method and the ethical considerations of the study. This is followed by a description of the data analysis methods and results for the four single case participants (Chapter 5). A discussion of the results is included in Chapter 6 together with reflection on the validity of the conclusions made. Further questions are posed resulting from these conclusions, and the practical application of aspects of the results for educational psychology practitioners are discussed.

3 Literature Review

3.1 Literacy learning

3.1.1 Basic skills in literacy

Literacy is defined by (UNESCO, 2005) as “the ability to identify, understand, interpret, create, communicate and compute, using printed and written materials associated with varying contexts. Literacy involves a continuum of learning in enabling individuals to achieve his or her goals, develop his or her knowledge and potential, and participate fully in community and wider society” (UNESCO, 2005, p. 21). It is widely recognised that differences in literacy attainment on leaving full time education have a significant impact on economic outcomes, specifically linked to an individual’s earnings and their likelihood of employment (Raudenbush & Kasim, 1998).

Literacy legislation and guidance

UK government have highlighted the broad extent of literacy, stating “Literacy skills, that is, reading and writing (and the skills of speaking and listening on which they depend), are essential cross-curricular skills: they are not *subjects* and are not confined to English lessons” (Rose, 2006, p. 10). The National Literacy Strategy (DfEE, 1998) highlighted the importance of targeting intervention for those students who exhibited the poorest attainment, introducing personalised learning programmes and increased literacy interventions. Although teaching of literacy within the literacy hour and progress monitoring improved following introduction of the national literacy strategy, reviews found this was not informing teaching sufficiently (Ofsted, 2005). Although many children received additional support or interventions, these did not closely match pupil needs. The Rose Review (Rose, 2006) emphasised that interventions were most successful when they were “focussed on the right children through careful assessment, regular updating and tracking of progress…[and] used assessment information to shape appropriate support” (Rose Review, 2006, p. 45), recommending that assessment informed any

additional Wave 2 intervention[1] work completed with pupils struggling with early literacy skills.

3.1.2 Gender differences in literacy attainment

The initial deficit for boys in reading is evident (Flannery, et al., 2000) with this gap increasing over the school career (Sullivan, 2009). Moreover Rutter et al. (2004) reported that the rate of males exhibiting reading difficulties was significantly higher than that of females. However measures used in these studies did not include assessment of phonological processing which may present a significant limitation to their conclusions of literacy difficulties (Bryant, Bradley, Maclean, & Crossland, 1989; Snowling, 1998). Shaywitz, Shaywitz, Fletcher and Escobar (1990) found an approximately equal prevalence of reading difficulties in male and female participants despite defining literacy difficulties through discrepancy with their IQ which has been a strongly refuted method of diagnosing literacy difficulties (Frederickson & Reason, 1995). A recent study found the prevalence of writing difficulties was 2-3 times higher for male pupils than females, with 25% of participants who had writing difficulties not exhibiting comorbid reading difficulties (Katusic, Colligan, Weaver, & Barbaresi, 2009). Wider variance of reading ability also appears to be shown by male compared to female pupils (Hawke, Olson, Willcut, Wadsworth, & DeFries, 2009), with low probability of reading differences but significant probability of lower writing skills for males than females (Berninger, Nielsen, Abbott, Wijsman, Raskind, 2008). The Progress in International Reading Literacy Study (PIRLS) report (Mullis, Martin, Kennedy, & Trong, 2011) indicates an increase in reading achievement for male and female students between 2006 and 2011, but there remains a significant discrepancy between male and female reading achievement.

Although internationally England is a higher performing country for reading achievement (Mullis, Martin, Gonzalez, & Kennedy, 2003) in an international comparison the UK exhibited a difference in gender performance which was

[1] The SEN Code of Practice referred to using a “graduated response” to children who displayed special educational needs within school Skills, (DfE a (2001). This was developed by the National Literacy Strategy (DfEE, 1998) into three waves of interventions, with Wave 2 incorporating small group interventions as part of a boost for students who would be expected to catch up as a result of these interventions .

smaller than only ten of 49 countries (Mullis, et al., 2011). Ofsted (2005) reported that for reading attainment at the end of Key Stage 2, consistently less male pupils then female pupils were achieving the average attainment level, with this gap widening consistently in writing attainment (Younger & Warrington, 2005). Although higher proportions of males identify themselves as non-readers than female (Jones, Fiorelli, Doiron, Scieszka, Haupt, Cox, 2003), some highlight the importance of male perception of the term 'reading', suggesting that this may reflect male reports of non-reading of novels but may miss their regular reading of other material (Sullivan, 2009). It therefore indicates a need for review of the modes of accessing literacy, and attitudes towards literacy which may be factors in this apparent discrepancy.

3.1.3 Gender differences in interest in literacy

Research has consistently found that female attitudes to literacy are more positive than male attitudes within the UK and internationally (Clark & Burke, 2012; Mullis, et al., 2003; Sainsbury & Schagen, 2004) with this potentially impacting on the amount of time students read (Logan & Johnston, 2009; News, 2014) and attainment in reading (McKenna, Kear, & Ellsworth, 1995). Although generally attitudes towards reading become less positive over time, for females, this attitude is more stable than males (Kush & Watkins, 1996). Interventions to promote pupil attitudes towards reading have been indicated to improve attainment towards reading alongside attitudes (McKenna, et al., 1995). Competency beliefs and self-esteem have also been found to have an effect on reading (Miserandino, 1996). Influencing the non-fiction reading habits of male readers has been exhibited to require strategies to encourage males to develop a masculine identity which incorporates reading as a desirable and valued activity (Smith, 2004). Eccles et al. (1993) reviewed the differentiation made between subjects by male and female pupils during primary school, with male pupils rating their competency as higher in maths and sporting activities, whilst female pupils rated their competency as higher in music. In relation to this, male pupils rated sporting activities as having higher task-value, whilst female pupils valued music and reading most highly. It may be important to explore potential underlying factors affecting task-value such as competence before gender differences from this study can be confidently asserted. Successful practices

attributed to diminishing the gender gap in reading attainment include the provision of reading challenges or competitions, involving parents and staff training (Clark & Burke, 2012).

3.1.4 Literacy interventions

Ofsted (2005) reported the progress in literacy attainment since the implementation of the National Literacy strategy in 1998 (DfEE, 1998). However this report noted that “too many pupils receive additional support, or undertake intervention programmes, which do not meet their needs well enough” (Ofsted, 2005, p. 2), linking to the need for detailed and specific assessment of pupil needs in order to cater for any deficits within teaching. The National Literacy Strategy for writing (DfEE, 2001) discussed the need to teach writing skills in a direct and systematic way as the conventions of written English and correct formation can be arbitrary. This led to an increased focus on writing as a key literacy skill within the national literacy strategy (DfEE, 2001) to be promoted particularly for male students (DfE, 2011, 2012b). Ofsted recommended improving boys’ writing skills and their attitude towards writing through the provision of direct feedback to the pupil on the content and form of his written work (Ofsted, 2003). Pedagogic learning, focussing on target setting and mentoring, and socio-cultural influences are also suggested to be important when planning literacy interventions for male learners (National Literacy Trust, 2012; Younger & Warrington, 2005), with motivation reviewed as key in promoting male attitudes to literacy (Bradshaw, et al., 2010).

3.2 Motivation

3.2.1 Introduction

A widely held general definition of motivation is, “a reason or reasons for acting or behaving in a particular way” (Oxford English online dictionary, 2013), with psychological definitions encapsulating further elements such as perceived control over the context (Weiner, 2005), attributions (Bandura, 1977), and social norms (Ajzen, 1991). Historically motivation was understood as behaviour driven by a series of innate physiological drives to meet basic needs (Brown, 1964; Hunt, 1965). Subsequent to these biologically based theories, behaviourism began to influence understanding of motivation as a pattern of learned behaviours and responses (Skinner, 1974), introducing the concept of cognitive mechanisms influencing behaviour. Motivation is highlighted in literature as a key aspect in promoting attainment (Archambault, Eccles, & Vida, 2010; Cassidy & Lynn, 1991; Miserandino, 1996; Ryan & Connell, 1989) specifically through increasing literacy promoting behaviours (Unrau & Schlackman, 2006). Moreover motivation towards reading is lower in the UK than in the international community (Mullis & Kennedy, 2003) with changing learners’ attitudes towards reading and writing seen to be imperative to raising attainment (McKenna, et al., 1995; Sainsbury & Schagen, 2004). Motivation is suggested to modulate over time and changes to motivation are shown to promote changes in school behaviours (Ames, 1992), thereby confirming the importance of considering motivation when teaching.

3.2.2 Theories of motivation

Social learning theory

Social learning theory describes all behaviour as an “interaction of the individual and his or her meaningful environment” (Rotter, 1990, p.491). Social learning theory postulates that human behaviour is frequently irrational and therefore motivated behaviour may not match the attributions named by the individual, and may not be applied identically in all environments (Rotter, 1990). Loci of

control [2] are assumed to be attributed differently in varying environments and may be generalised in some contexts (Blackman, 1962; Phares, 1957). Behaviour across contexts is assumed to be different, "although there may be a gradient of generalization from one situation to another" (Rotter, 1990, p. 491). Therefore an understanding of individual experience is suggested to be required to understand motivating factors for that individual (Weiner, 1979). When reviewing research previously analysed as indicating intrinsic or extrinsic motivation, Rotter (1990) found that expectancies of future success differed when individuals received differing re-enforcers. For example students were likely to repeat behaviour in tasks when reinforcement to a task was perceived to be based on their competence, rather than dependent on chance or experimenter control (Blackman, 1962). The elements of reinforcement value, expectancy and generalised expectancy are therefore key concepts within social learning theory (Weiner, 1972).

Attribution theory

Attribution theory (Kelley, 1967) focuses on cognition, positing that human beings are scientists trying to understand themselves and the environment around them, using information, beliefs and motivations to perceive the causes of past behaviours or outcomes, with loci of control within social learning theory focussing on using attributions to perceive future events (Stipek, 2002). Attribution theory (Kelley & Michela, 1980) discusses that attributions are affected by previous events, in addition to shaping each person's conceptions of themselves and those around them (Thibaut & Riecken, 1955). Weiner (1979) states that the perceived locus of internal or external control attributions can be located within two further dimensions; stability (duration) and controllability (individual control over an outcome). The type of attribution made about control has been shown to affect individuals' expectations of future outcomes, and had an impact on the generalisation of these expectancies to other tasks (Phares, 1957). Weiner (1979) proposed the following figure that cross-categorises

[2] Loci of control refers to individuals' internal or external attributions for outcomes of behaviour "the degree to which persons expect that a reinforcement or an outcome of their behavior is contingent on their own behavior or personal characteristics versus the degree to which persons expect that the reinforcement or outcome is a function of chance, luck, or fate, is under the control of powerful others, or is simply unpredictable" Rotter, 1990, p. 489).

behaviours according to spectrums of stability and controllability and indicates the likelihood of an internal or external causal attribution.

Table 3.1 Table adapted from Weiner (1979, p.; 1992, p. 250)

	Internal		External	
	Stable	Unstable	Stable	Unstable
Uncontrollable	Ability	Mood	Task difficulty	Luck
Controllable	Typical effort	Immediate effort	Teacher bias	Unusual help from others

Initially the stability and controllability elements proposed by Weiner (1979) were applied within achievement contexts (Marsh, Cairns, Relich, Barnes, & Debus, 1984). However research applying these elements to other fields has also been shown to have valid application in explaining spontaneous human reasoning of causes; these include attributions linked to feelings of loneliness (Michela, Peplau, & Weeks, 1982) and feelings of learned helplessness (Abramson, Seligman, & Teasdale, 1978), theorising that cognitive treatment should incorporate work to change attributions about failure to external, unstable and specific loci, whilst adapting attributions for success to internal, stable and universal loci. This was received by some as providing only a partial explanation of behaviour associated with learned helplessness, and leaving uncertainty regarding the bi-directionality of the impact of motivation (Wortman & Dintzer, 1978). However it paved the way for attributional theories to be used to understand the interaction between perception and behaviour (Schunk, 1981). Weiner (2005) suggests that it is only with this understanding of individual attributions of locus of control, stability and controllability that motivation can be impacted or changed.

Self-efficacy

Bandura (1977) described understanding motivation as a driver for behaviour change through the perspective of self-efficacy. This is founded in motivation as a cognitive function, with an individual setting a goal and evaluating behaviour

to ensure these goals have been reached. Bandura introduced the element of self-efficacy beliefs, describing that perceived self-efficacy regarding achievable goals impacted an the individuals' motivation and therefore choice of behaviour. The theory of self-efficacy (Bandura, 1977) is described as correlated to self-concept, this defined as an individuals' perception of self-competence and values. These perceptions when impacted by increased evidence of competence and success, are suggested to improve self-efficacy and resulting motivation to engage in further tasks (Bong & Skaalvik, 2003). Ajzen (1985) further developed this perspective in the theory of planned behaviour, detailing that motivated behaviour occurs as a result of intention. Intention is impacted by the individuals' perceived control over the behaviour, attitude towards the behaviour goal and social norms surrounding the behaviour (Ajzen, 1991). Understanding human perceptions and attributions therefore became increasingly important to exploring and enhancing motivation.

3.2.3 Achievement and competence motivation

The theory of achievement motivation is rooted in the early cognitive theories of psychologists studying the impact of 'volition' and intentions on perseverance (Ach, 1910) and aspiration to achieve a goal as a key motivating factor in completing the goal (Bandura, 1977; Lewin, Dembo, Festinger, & Sears, 1944). Achievement motives originate in the premise of innate drivers for motivation, where negative affect is produced through failure or high levels of challenge in a task, subsequent motivation is then elicited in future task phases to avoid failure (McClelland, Atkinson, Clark, & Lowell, 1953). Further developments of this theory (Pintrich, 2000) have highlighted the preference of avoiding failure (Elliot & Church, 1997; Skaalvik, 1997), mastery achievement producing more cognitive engagement (Meece, Blumenfeld, & Hoyle, 1988) and the positive outcomes in terms of self-efficacy and affective outcomes of achievement mastery over a goal (Ames, 1992). Dweck (1986) purported that self-perceptions and attributions made by an individual regarding their achievement outcomes are integral to understanding motivation. Dweck and Molden (2005) indicate that individuals' self-theories about the causes of their competence feed into their self-worth and motivation, and defensive strategies are used by individuals to avoid threats to their competence. Dweck (1986) characterises

adaptive motivation as that which is 'mastery orientated', describing this as "characterised by challenge seeking, and high effective persistence in the face of obstacles" (Dweck, 1986, p. 1040). Achievement motivation hypothesises that affect impacts on motivation which in turn effects behaviours (McClelland, et al., 1953). McClelland et al (1953) suggested that achievement motivation can be enhanced by introducing challenging tasks which an individual is intrinsically motivated to overcome. Dweck (1986) made the distinction between learning and performance outcomes as having an important impact on understanding achievement motivation; performance outcomes as characterised by motivation to gain positive external judgement and avoid externally perceived failure, and learning outcomes characterised by individuals being motivated to increase their individual competence in a task. A focus on mastery within a learning environment is reported to induce learners to seek challenge (Ames & Archer, 1988); mastery within this paradigm is typically perceived as relying on individual effort (Skaalvik, 1997). McClelland (1953) highlights that this challenge level is required to reflect the individual; too low and attention will decrease, too high and the individual is likely to experience negative affect and perceived likelihood of failure. Harter (1978, 1981) describes the intrinsic drive to achieve mastery or competence as the 'effectance motive'.

Competence

Competence is defined as, "the capacity to produce effective goal-directed behaviour on demand" (Rhodewalt & Vohs, 2005, p. 548). Research indicates that competence is a key factor in self-worth (Rhodewalt & Vohs, 2005), and that individuals' self-theories about the causes of their competence feed into their self-worth and motivation (Dweck & Molden, 2005). Dweck (1986) stated that an individuals' perception of their ability and confidence in a task could produce differing behaviour patterns; for learning outcomes, high or low confidence of an individual would produce the same behaviour outcome of seeking challenge and persisting in the task, where low confidence in performance based outcomes would produce feelings of helplessness where individuals would reduce their persistence and the level of challenge sought. Following completion of a review of research Heyman and Dweck (1992)

described that learning orientated goals are linked with intrinsic motivation to a task, with increased persistence and active engagement in challenging tasks, thereby promoting competence and mastery. However the role of performance goals were included in an adaptive developmental model of motivation, specifically aspects of challenge and feedback, highlighting that challenge and specific feedback on the level of current achievement rather than broad statements about overall competence can be helpful in supporting adaptive motivation (Heyman & Dweck, 1992).

Learners' competence beliefs about school subjects generally decrease over time during their educational career (Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002), however pupil self-concepts of their ability in third grade have been shown to be predictive of the amount of reading pupils completed for pleasure in tenth grade (Durik, Vida, & Eccles, 2006). Research indicates interventions to increase task fluency are correlated with increased self-competence beliefs (Quirk, Schwanenflugel, & Webb, 2009).

Subjective task value and ability self-concepts[3] represent two widely studied components of literacy motivation (Baker & Wigfield, 1999). Archambault, Eccles & Vida (2010) reported a pattern of decreased ability self-concept and subjective task value for literacy, with this decrease more evident for male, low socio-economic status pupils who presented reading difficulties and motivational declines in the first two years of school. This pattern of decreasing motivation towards reading has been evidenced in other studies (Unrau & Schlackman, 2006), with task-value ratings of academic activities decreasing during middle elementary school (Archambault, et al. 2010; Eccles, et al., 1993) and competency beliefs indicated to mediate changes to the value placed on activities (Durik, et al., 2006). Archambault et al. (2010) suggest that students who show early signs of de-motivation with regard to literacy, "should be the targets for interventions that promote intrinsic motivation and competence for reading while they still perceive themselves as having good abilities and believe reading and writing is important" (Archambault, Eccles and Vida, 2010, p.813).

[3] Ability self-concept refers to children's assessment of their capability to perform well in a domain. Subjective task value is generally defined as specific to the individual, with links to child interests, perceived utility, cost, and intrinsic motivation (Wigfield & Guthrie, 1997).

3.2.4 Impact of motivational factors on literacy and learning behaviour

Research indicates that attributing a positive outcome as created by the self is desirable and promotes positive self-esteem (Feather, 1967). Baker and Wigfield (1999) indicated that factors of self-efficacy and challenge were significantly positively correlated with children's reports of time spent on reading. Dai and Wang (2007) also reported the positive impact of goal directed and intrinsic motivational factors on levels of reading comprehension. In a longitudinal study of pupils in Grades 3, 4 and 6 (Becker, McElvany, & Kortenbruck, 2010) intrinsic motivation towards reading corresponded to the amount of time spent reading as previously reported by Wigfield and Guthrie (1997). Researchers suggest a bidirectional effect of motivation and literacy behaviours, suggesting that students who experience difficulties with reading develop higher levels of extrinsic motivation which in turn inhibits reading for pleasure (intrinsic motivation) (Becker et al., 2010). Supporting intrinsic motivation in the classroom environment has been suggested to have an impact on student motivation to engage in activities (Ames, 1992; Grant, 1993). Weston (1989) described the effects of summative testing as potentially damaging to motivation through emphasis of failure for students who struggle. This corresponds to research indicating that summative assessment negatively impacts self-efficacy and learning self-esteem (Harlen & Crick, 2002).

3.3 Assessment through teaching

3.3.1 Formative and summative assessment methods

Both summative and formative assessments are promoted within the current academic system (Childrens Schools and Families Committee, 2008; National Foundation for Educational Research, 2013; DCSF, 2009). Recent legislation emphasises the value of assessment through teaching and aspects of formative assessment (Bew, 2011; Black & Wiliam, 1998) indicating that this type of assessment has importance in differentiating the curriculum to support the specific needs of learners. Black and Wiliam (1998) indicated that formative assessment offers a method by which learning can be improved, recommending elements of formative assessment which support successful outcomes: "setting

of clear goals, the choice, framing and articulation of appropriate learning tasks, the deployment of these with appropriate pedagogy to evoke feedback…and appropriate interpretation and use of that feedback to guide the learning trajectory of students" (Black & Wiliam, 1998, p. 46). They also note that staff should show a commitment to involve learners in the assessment of their own learning and joint assessment of learning with peers. Irons (2008) discusses the importance to learning of both quality and time-specific feedback, highlighting that formative feedback is a key assessment process which produces this. Formative assessment has been reported to have a positive impact on pupil self-perceptions of themselves as learners (Miller & Lavin, 2007).The theoretical underpinning of formative assessment is described as constructivist (Black & Wiliam, 1998), reviewing how each pupil construes the curriculum and adapting teaching instruction and assessment to support each pupil's specific learning needs and understanding (Torrance & Pryor, 2001).

3.3.2 Precision Teaching

Precision Teaching (PT) (Raybould & Solity, 1982b, 1988a) is a method of monitoring pupil progress during teaching. It is based on reviewing the environmental factors such as curriculum sequence, mastered skills, un-mastered skills and teaching arrangements alongside continuous assessment of progress to promote learning. PT guides daily assessment and teaching through utilising principles based in the instructional hierarchy (Haring et al., 1978), which provides a theoretical framework to match the pupil's current level of skill with the stages required to further develop this skill. Fluency within the hierarchy is defined as use of both accuracy and speed, indicating retention of the learnt skill by being able to produce it quickly whilst maintaining accuracy (Daly, Lentz, & Boyer, 1996). The theory of optimal instruction builds on this theoretical perspective, stating that the environment and teaching can be analysed to create a context where the learner will experience success through appropriate challenge (Solity & Vousden, 2009). This approach states that "without assessment there can be no adequate teaching, without teaching there can be no adequate assessment" (Raybould, 2002, p. 13). In this way, PT is a form of assessment for learning, "Assessment for learning is any assessment for which the first priority in its design and practice, is to serve the purpose of

promoting students' learning…assessment becomes 'formative assessment' when the evidence is actually used to adapt the teaching work to meet learning needs" (Black, Harrison, Lee, Marshall, & Wiliam, 2002, p. 10), and which has been recently highlighted within government guidance to provide an important feedback mechanism to guide literacy interventions (Ofsted, 2005; Rose, 2006).

PT provides a measure of proficiency which is gained by examining both what a pupil is able to do and how quickly they are able to do it (Lindsley, 1992; Raybould & Solity, 1982a). UNESCO (2005, p. 40) note that speed and accuracy are essential stages when developing literacy skills, and research states speed gives an indication of expertise (Chiesa & Robertson, 2000). Much research has been conducted evidencing the positive impact of PT including promoting pupil attainment of basic literacy skills (Cavallini, Berardo & Perini, 2010; Heath, 2009), basic numeracy skills (Chiesa & Robertson, 2000) as well as motor function (Fabrizio, Schirmer, King, Diakite, & Stovel, 2007), memory (Ayers, Potter, & McDearmon, 1975), and basic skills following brain injury (Chapman, Ewing, & Mozzoni, 2005; Kubina, Ward, & Mozzoni, 2000). It has also been successfully used to monitor progress for adults (Ayers, et al., 1975), students who have a diagnosis of Downs Syndrome (Irwin, 1991) and ASD (Fabrizio & Moors, 2003). Recent research has highlighted the potential PT has to promote motivational alongside academic changes in pupil's literacy skills in primary (Downer, 2007) and secondary settings (Roberts and Norwich, 2010). However criticism of the behaviourist foundations of PT instruction exists (Raybould & Solity, 1988a), specifically with this behaviourist paradigm leading to over-emphasis on adapting the learning environment rather than focussing on the individual learning differences of the child (Ballard, 1987).

Rose (2009) indicates that by the age of seven, pupils have learned many literacy skills to a level of automaticity which places them in a positive position to succeed in their educational career. This review also states that "to do this requires well-structured, systematic teaching, regular application and practice" (Rose, 2009, p. 10). Structured teaching alongside a framework for regular practice and assessment are elements PT is indicated to provide (Binder & Watkins, 1990; Raybould & Solity, 1982b).

3.4 Systematic literature Review

The following review of current literature has been conducted to explore the themes of Precision Teaching and motivation as outlined above. Systematic reviews aim to provide an objective and comprehensive summary of the best evidence available on a subject. Guidance from The Cochrane Review (Higgins & Green, 2011) has been sought to guide this literature review. This guide states that a systematic review should contain

- a clearly stated set of objectives with pre-defined eligibility criteria for studies,
- an explicit, reproducible methodology,
- a systematic search that attempts to identify all studies that would meet the eligibility criteria,
- an assessment of the validity of the findings of the included studies, for example through the assessment of risk of bias,
- a systematic presentation, and synthesis, of the characteristics and findings of the included studies.

The methodology followed by the reviewer was based on the guidelines as defined by the Evidence for Policy and Practice Information and Coordinating Centre (EPPI - Centre, 2010). These protocols highlight the importance of including a transparent and explicit method of searching for articles for a proposed research question.

In order to identify papers which were representative of the terms being searched, the database thesauruses were used to improve the likelihood of finding papers which matched the search criteria and were relevant to the research question posed. Keywords were included in the search terms used for the current systematic review (see Appendix 27) following the convention of 'pearl searching' documented by the EPPI-Centre (EPPI-Centre, 2010).

3.4.1 Search criteria

Electronic searches and hand searches were used alongside using general search engines with the aim of gaining a comprehensive view of the relevant literature available (EPPI-Centre, 2010). The databases Psych INFO, ASSIA, Web of Knowledge and Wiley Online were searched through entering search

terms into the electronic databases and Educational Psychology in Practice was hand-searched for research which met the inclusion criteria.

The following question was used to guide searches within these data-bases:

What does the research evidence suggest is the impact of Precision Teaching on motivation towards literacy and learning attainment for male pupils in Key Stage 2 (aged 7-11)?

3.4.2 Inclusion and Exclusion criteria

Inclusion criteria:

- Research focussed on measuring the impact of a Precision Teaching (PT) intervention,
- Research documenting literacy outcomes for participants,
- Research focussed on participants of school age (i.e. between 5 and 16 years old),
- Papers written in English,
- Comments on the affective factors of PT for participants.

Exclusion criteria:

- Research which does not include Precision Teaching,
- Research which focusses on participants not of school age,
- Research which is not written in English,
- Papers with a methodology based on the opinions of researchers or written as a theoretical discussion of the topic and therefore does not include a directly implemented research study,
- Precision Teaching interventions focussed on non-literacy skills,
- Research using Precision Teaching only with a non-typical population (i.e. Downs Syndrome, ASD, traumatic brain injury).

Inclusion in the literature review was decided on the following Weight of Evidence (WoE) model (Gough, 2007). This follows the model as defined by the EPPI-Centre (2010, p. 14):

“A: The trustworthiness of the results judged by the quality of the study within the accepted norms for undertaking the particular type of research design used in the study (methodological quality)

B: The appropriateness of the use of that study design for addressing the systematic review's research question (methodological relevance)

C: The appropriateness of focus of the research for answering the review question (topic relevance).

D: A combination of the process undertaken in steps A-C to provide an overall assessment of the extent to which a study provides evidence to answer the question posed by the systematic review” (Gough, 2007).

Of the 337 papers identified within the searches, 26 papers were reviewed with nine of these included in the final systematic review (see Appendix 26 for a full review of these papers and the WoE judgements made). Typically papers were excluded due to a lack of description of any motivational outcomes of Precision Teaching which resulted in limited relevance to the research question this paper is aiming to address. In order to allow the reviewer to extract comparative details from each paper, the following structure was followed:

- Rationale and purpose of the study,
- Research question the study aims to address,
- The context of the study,
- Participants in the study,
- Methodology,
- Reliability of intervention used,
- Measures used within the study,
- Data analysis,
- Ethical implications of the study,
- Conclusions drawn,
- Limitations of study,
- Implications for future research.

3.4.3 Papers

Brooks (1995) The purpose of this study is to investigate how teaching methods and curriculum impacted learning, specifically focussing on the themes of teaching content structure and teaching strategies and instruction, the premise of these being that teaching and instruction need to be matched with individual pupils' strengths and weaknesses in their learning.

This single case study was completed with a male participant (aged 11 years, 10 months) to teach word spelling. During the pre-tests, the pupil indicated difficulties with phonological skills and auditory memory. The experimental hypotheses for the study indicated that the pupil would make progress in learning word spellings when a highly structured teaching approach was used with corresponding reinforcement. A further experimental hypothesis was that pupil progress would be supported by tailoring instruction and content to his specific strengths and weaknesses. Precision Teaching was therefore used to monitor pupil literacy success within a changing criterion design. A total set of high frequency words (HFW) were tested prior to the start of the intervention, 6 weeks after instruction and 12 weeks after instruction. The total list of unknown HFW were taught using the methods of look-say, tracing, simultaneous oral spelling, findings words in words, phonics teaching, spelling rules, and a baseline phase where each word was presented with no instruction.

Significant learning progress ($p=0.005$) in visual and semantic teaching phases indicated the pupil responded better to activities tailored to his areas of strength. The researcher concluded that merely applying a structure to learning which includes reinforcement, monitoring and teaching may not produce successful results. For this pupil qualitative investigation of methods which were likely to best fit the learner supported positive affect, engagement and learning progress. Further discussion of the interaction of these elements is not discussed. Within the Weight of Evidence (WoE) model (Gough, 2007) the changing criterion design was completed in accordance with methodological standards, although replication is required for generalisation of results. The

research comments on using PT to match instruction and teaching, and how this may meet the affective needs of the participant, providing a contribution to the focus of the current research paper. SCED methodology is used to review the effects of PT on learning attainment of a single participant which appears to be an appropriate methodology for the focus of the research. According to the WoE model (Gough, 2007), this paper is therefore relevant to the systematic review research question.

Downer (2007) explored the effect of Precision Teaching (PT) on learning affect and word reading accuracy in pupils' literacy skills for 47 pupils across Key Stage 1, 2 and 3 in the UK using a fixed group design. The study focuses on teaching high frequency words in a 4 minute daily session measured through Precision Teaching probing accuracy and fluency. All pupils received the Precision Teaching intervention to monitor high frequency word (HFW) reading accuracy. No control group was used within this research. T-tests were used to ascertain any significant differences between pre and post-test measures. This study also discusses the attitudes of teaching assistants (TAs) and pupils towards PT. There were substantial increases in the mean number of words known after the intervention, however limited participant numbers within each year group prevented significant differences on analysis. Throughout the age ranges, male participants produced a lower initial accuracy level than female participants. Within the Key Stage 2 school participants, male pupils scored higher than female pupils following the intervention and made higher progress increments. An average increase in performance of students is reported alongside the appeal of PT to stakeholders, and the positive impact it had on children's confidence in reading as perceived by staff. Staff noted some pupil behaviour changes, and anecdotal views from Teaching Assistants (TA) and teachers reported predominantly positive views regarding the intervention process and the generalisation of confidence and skills in the wider curriculum. The average period of exposure to PT sessions was 22 weeks, however the full range of exposure varied from 2 to 26 weeks. It is unclear how this difference in the length of session exposure was controlled for within the data analysis. The non-homogeneity of the intervention received by participants and the absence of a control group produces difficulty in applying scientific rigour to data

analysis. Although the group design methodology includes flaws which limit conclusions about the improvement in accuracy of participants, this paper begins to explore the affective outcomes of PT. For this reason, this study was included in the literature review as this is relevant to the current research.

Roberts and Norwich (2010) used a quasi-experimental design to investigate the effect of Precision Teaching (PT) on pupil word reading and academic self-concept. The research primarily investigated the effect of PT on word reading and academic self-concept over and above the changes made with usual teaching arrangements. This research was completed with 77 participants from five secondary schools, aged between 11 years and 4 months to 16 years and 2 months. Participants were separated into two cohorts for participation, the first cohort taking part in the study during terms 1 and 2 of the school year, and the second cohort taking part during terms 3 and 4. Random allocation was used across year groups to assign pupils to an intervention or control group in each cohort, with the control group receiving the usual teaching arrangements for six weeks before receiving PT. Reading accuracy as measured by the 332 high frequency words (HFW) as taken from the National Literacy Strategy (DfEE., 1998) was measured at the start of the project, 6 weeks after either intervention for experimental groups or baseline for control groups, and after a further 6 weeks of intervention for control groups and removal of PT for experimental groups. Participants perceptions of themselves as learners was measured using the Myself as a Learner Scale (MALS) (Robert Burden, 1998) at identical times to the HFW measure. There were significant differences ($p<0.05$) between pre and post-intervention MALS scores for control and experimental groups in Cohort 2. The authors hypothesise that increased confidence and self-efficacy (Bandura & Locke, 2003) were supported through a higher level of fidelity to the Precision Teaching practices in Cohort 2. The researchers identified that further research is required to explore the wider effects of PT on motivation of learners through exploratory methodologies. Usual teaching methods differed between schools, therefore producing difficulty in isolating the independent effects of PT. The research conclusions were extremely relevant to the present research paper. This study was therefore included in the review.

Kessissoglou and Farrell (1995) implemented PT to support 12 pupils in Year 5 and Year 6 with their word reading. These pupils were identified using the Neale Analysis of Reading Ability (NARA) (Neale, 1989) as functioning at least two years behind their chronological reading age. Pupils were randomly allocated to one of three groups; control, reading intervention and PT. Pupils in the reading and Precision Teaching groups were given a 15 minute session with a teacher in which the pupil read an unfamiliar book, learned to read unfamiliar individual words and was then assessed through probes as advised within PT literature (Raybould & Solity, 1982b). Within the reading group the participants played unspecified educational games and discussed school rather than receiving direct reading instruction. Researchers reported that participants maintained their knowledge of the words they had learned at a five week follow-up assessment. Results from the NARA indicated that the PT group made slightly more progress than the other groups in word reading accuracy, with higher progress in reading comprehension although statistical analysis of these improvements were not provided. Kessissoglou and Farrell (1995) report wider reaching effects on the self-confidence of the learner within reading. However this is not quantitatively analysed and is a qualitative conclusion after reflection on participant engagement with PT. Using the WoE model (Gough, 2007) this research paper lacks elements of methodological rigour. However the qualitative reflections in the study contribute information on the potential affective influence of PT. It was therefore included as part of a body of research beginning to explore the affective and motivational outcomes of PT.

Selfridge and Kostewicz (2011) report four case studies of pupils attending third grade in a US elementary school. It documents the implementation of PT to support delayed literacy skills. Participants attended the third grade in an elementary school in the USA and were aged between 8 and 9 years of age. Each participant received a literacy intervention session each day for 10 weeks. The aim of these sessions was to increase fluency and accuracy of word reading, with progress monitored through Precision Teaching. For two participants, qualitative results indicated that PT initiated competition which appeared to motivate effort in sessions. This study also reported that for two

participants, tailored teaching and instruction to the specific needs of the pupils was important to their learning progress. All participants were described to show pride and increased enthusiasm in their learnt skills. As a case study based paper, the methodology has limited measures to ensure removal of researcher bias as all measures and description are based on feedback from the researchers. Further limitations of the study are recognised by the researcher, with participant attrition and case study methodology creating results specific to the individuals, therefore not generalizable to wider populations. Using the WoE (Gough, 2007) factors specified at the beginning of this review, this study included limited information about participants therefore lacking analysis of wider confounding variables which may have impacted outcomes. However the qualitative description of participant responses to the PT programme further indicate that elements of competition and motivation may be impacted by PT, with further scientifically controlled replication of these effects in wider populations required.

Sharpley and Rowland (1986) investigated the effects of a number of interventions as monitored by PT; to review their effectiveness in reducing the negative impact of academic stressors and promoting success. Fifty participants aged between 9.0 to 11.9 years (32 male) took part in this study. The research was carried out in four Australian rural primary schools. Participants were randomly allocated to one of five teaching conditions; Electromyographic (EMG) biofeedback, muscle relaxation whilst reading relaxation script, remedial teaching, daily measures only and control group. The GAP Test of Reading Comprehension (McLeod, 1977) was used as a pre and post measure of comprehension performance level. The St Lucia Graded Word Reading Test (Andrews, 1977) was also used as a pre and post measure of word reading. Probes used within this research were passages of prose followed by comprehension questions on this passage. Fluency and accuracy were measured by noting the errors and correct words given in the first 100 words of the passage. Fluency and accuracy were measured after each session. Direct action as referring to providing remedial teaching appeared to significantly improve reading accuracy and comprehension ($p<0.05$), with relaxation also positively impacting accuracy rates ($p<0.05$). This study concluded that it is

teaching with feedback on learning which appeared to make a difference to literacy learning. Researchers suggested future research could be conducted on reducing the threat of failure and the effect of this on the affective outcomes for students. Using the WoE framework (Gough, 2007) input time received in the remediation condition is a confounding variable which is likely to have positively biased the significance of the impact of this condition. Probes used to monitor accuracy and fluency are used throughout with comment on the positive impact of feedback, therefore this study was deemed relevant for the current literature review.

Stump, Lovitt, Fister, Kemp, Moore, and Schroeder (1992) reported a 4 year collaboration between the University of Washington and Utah Learning Resource Centre to equip teaching staff with evidence based instructional skills. Two year cohorts of PT training were completed for staff with the purpose of reviewing the training required for teaching staff to implement the PT skills taught, the progress it promoted for students who have literacy difficulties and to investigate the views of staff and students towards PT. The literacy teaching focussed on increasing knowledge of word meanings. Eighteen members of staff from 6 secondary schools implemented PT with 351 pupils. The research design incorporated a baseline and intervention phase, followed by follow-up phase. During the intervention phase Precision Teaching probes were introduced and students collaborated to take turns in sharing the roles of teacher and learner for 5-10 minutes 3 times per week. Probes were marked and students received daily feedback on their scores. During the retention phase, no vocabulary teaching or recapping occurred, instead probes were introduced to measure on-going retention of previously learned vocabulary. Although consistency of these phases promoted validity in comparing the outcomes of PT, the phases particularly during baseline and intervention periods were short. The PT intervention may therefore have been implemented for an insufficient time to reasonably expect an effect, in addition to the baseline phase being of insufficient length to provide a valid control for comparison. Student fluency and accuracy was described to improve as measured by calculation of fluency and accuracy rates from each probe. However no further statistical analysis was undertaken on this data. For the majority of teachers

and students a positive perception of PT was reported through Likert responses, with students reporting that they perceived it had improved their learning. However in Cohort 1 students also reported a lack of belief that PT would support their learning progress in other classes, whilst in Cohort 2 students reported that PT implementation could become tedious. With consideration to the WoE model (Gough, 2007) monitoring of teacher implementation of PT was a methodological weakness, therefore potentially decreasing intervention fidelity. Qualitative conclusions suggested that involving student participants in their own learning may be an important part of the success of PT. The consideration of student views and the affective outcomes of PT establish relevance to this literature review.

Updike and Freeze (2001) reviewed a precision reading intervention with a single participant within a case study methodological design. The participant displayed limited reading confidence and skill. This study aimed to review the impact of Precision Reading on fluency and any changes to enjoyment and confidence in reading experienced by the participant. This study developed a depth of knowledge of this single participant through a variety of qualitative data collection techniques. During the intervention, total number of words read correctly and the total number of miscues were totalled following the participant's reading of a passage, and results recorded on the graph. The participant increased his fluency and accuracy to pre-determined levels. The researcher also described pupil pride in achievement and increased confidence when reading the passages during the intervention. Although the researcher clearly defined the limitations of the study, no researcher biases or credentials of the researcher were made clear therefore limiting a review of the quality of the case study (Robson, 2011). The researcher clearly indicates factors within the study such as the focus on fluency and accuracy that would require further research to generalise the results to other individuals, populations or skills. The researcher indicates pertinent questions for further research to apply precision reading with varying populations to determine who could be supported by this approach, the breadth of the impact on literacy skills, the transfer of progress in the intervention to wider academic content and the maintenance of skills after the intervention has ceased. On review of the WoE factors (Gough, 2007) the

researcher clearly acknowledges the limitations of application of the study, in addition to noting the depth of detail about the single participant provided by the case study methodology. As the study included motivation outcomes of PT for this participant, it was included for discussion in this literature review.

Conclusions

From the papers consulted within the systematic review, several papers anecdotally refer to an increase in student confidence, self-efficacy and positive affect during PT interventions (Brooks, 1995; Downer, 2007; Kessissoglou & Farrell, 1995; Selfridge & Kostewicz, 2011). However this is not an element which has been specifically focussed on within the research base, the exception being Roberts and Norwich (2010) who found changes in student perceptions of themselves as learners after receiving PT. However this design focussed on group changes which did not allow for in depth exploration of the individual affective experiences of the participants completing PT sessions. Single case and small group designs have been widely used to investigate the effects of PT on learning in a number of varying contexts (Anderson & Alber, 2003; Bank, Le, & Fabrizio, 2003; Behan, 2004; Brandstetter & Merz, 1978). However these small studies have to date not been used to focus on the teaching and progress monitoring methods within PT and the effect these have on motivational factors. This systematic literature review therefore indicates that research focussing on the impact of PT interventions on motivational factors would provide an original contribution to the current research evidence.

3.4.4 Rationale

Lower literacy outcomes of male pupils have been described (Entwisle et al., 2007; Flannery, et al., 2000; Mullis, et al., 2011) in addition to the importance of literacy to future positive outcomes (Douglas, 2009; Raudenbush & Kasim, 1998). It is therefore of importance to explore the impact of interventions which promote literacy skills in this population. Whilst progress in literacy is lower for male than female pupils, research also indicates a negative attitude towards

literacy (Sainsbury & Schagen, 2004), a decrease in the perceived value of literacy for male pupils (Clark & Burke, 2012; Eccles, et al., 1993), and lower levels of motivation to engage in literacy activities within this population (Younger & Warrington, 2005). Precision Teaching is reported to consistently support progress (Cavallini, Berardo, & Perini, 2010; Chiesa & Robertson, 2000; Heath, 2009), with some anecdotal references to the effect of PT on motivation towards learning (Downer, 2007) and research indicating changes in learning self-efficacy following PT implementation (Roberts & Norwich, 2010).

The systematic literature search has indicated that there is a lack of research which considers the impact PT has on a population vulnerable to low self-academic perceptions and limited motivation towards learning. For a factor such as motivation, the theoretical background would suggest individual perceptions can create differences in 'motivated behaviour' (Kelley & Michela, 1980; Schunk, 1981), therefore indicating a need to investigate the effects of PT at an individual level. Drawing on the work of Baker and Wigfield (1999) and Durik et al. (2006) it is hypothesised that there is a theoretical basis for the impact of motivation on learning, in addition to an evidence base for the success of PT in supporting learning (Cavallini, et al., 2010; Oskar-Groen, 2010). It is further hypothesised that the implementation of PT may therefore have an impact on their academic self-concept, confidence and motivation towards learning (Roberts & Norwich, 2010).

The current study assumes the multi-faceted nature of motivation including attributions such as self-competence (Dweck & Molden, 2005) and loci of control (Feather, 1967) alongside extrinsic environmental and intrinsic drivers of motivation. The current study therefore aims to explore the impact of PT on the motivation and self-efficacy of pupils who exhibit low motivation towards literacy, and to systematically monitor and evaluate any changes to motivation that occur and reflect on the mechanisms through which these changes occur. This is reflected in the following research questions.

3.4.5 Research question

Overall research question: What is the impact of Precision Teaching on the motivation towards literacy learning of male pupils in Year 5 and Year 6?

The overall research question can be differentiated into further sub-questions:

Table 3.2 Table to show research questions

Research question	Research design	Measure
1. Does Precision Teaching have a positive effect on control attributions of male pupils towards literacy learning outcomes?	Series of four single-case experiments	Multidimensional Measure of Children's Perceptions of Control (MMCPC) (Connell, 1985).
2. Does Precision Teaching have a positive effect on academic self-efficacy perception of males towards literacy learning?	Pre and post intervention data.	Myself as a Learner Scale (MALS) (Burden, 1999).
3. How might Precision Teaching impact on motivation towards literacy for these pupils?	Post intervention data	Semi-structured interview with individual pupils to explore the following motivation information: - Internal and external attributions

		for learning outcomes - Loci of control - Achievement motivation - Social learning theory

4 Methodology

4.1 Introduction

This chapter describes the basis for the research design and methodology used within this project. The philosophical considerations of the researcher are described including a discussion of ontological and epistemological factors leading to the development of this research project. Explanation of how these considerations culminated in the research design chosen by the researcher are stated alongside a description of the measurement techniques used. The chapter concludes with a description of the single case experimental design method used within this project and consideration of the ethical implications of the research.

4.1.1 Philosophical traditions within research

Cohen, Manion and Morrison (2011) indicated that any research project must begin with considerations of the differing views of reality or truth (ontology), considering how we acquire knowledge (epistemology) and guiding the methodology, data collection instruments and to some extent the data analysis of any project. This project aimed to be a science based piece of research (Robson, 2011) carried out using systematic thought processes, and ensuring the research is completed with consideration to ethical implications. A key component when planning and implementing this research project was to seek findings which are reflective of, and relevant to, the real world practice of educational psychologists.

4.1.2 Ontological considerations

Within the methodology of a research project, the view of reality (ontology) taken by the researcher and participants is a fundamental factor defining the research methods. Key to the ontological debate are the differing approaches of perceiving the world. Broadly nominalism states that there are no universal truths, and truths are particular to context or object, with knowledge being defined by the person perceiving it. Pure realism holds that knowledge has an independent existence regardless of the person perceiving it, because it is a result of an objective reality. Within the social sciences Cohen et al. (2011, p. 7) discuss that the nominalism-realism debate highlights the poles of the spectrum

between subjectivity and objectivity within research. This spectrum is key to the assumptions made by researchers about the subject of the study and therefore the positioning of the research methods; this being the extent to which a social phenomenon is imposed on an individual as a result of its external objective existence (realism) or the extent to which this is a product of each individuals' cognitive interpretation of the social context (nominalism) (Cohen et al., 2011).

4.1.3 Epistemological considerations

Comprehending the world around us can be attempted using inductive, deductive or a combined inductive-deductive reasoning approach (Cohen, et al., 2011). Inductive reasoning highlights experiential knowledge whilst deductive reasoning focuses on gathering evidence to prove or disprove a hypothesis leading to knowledge gained through reasoning. This led to the assumption that any scientist who conducted careful testing and analysis of enough evidence could make 'true' scientific discoveries (Mouly, 1978). Cohen et al. (2011) indicate that the scientific method to approaching research is that of a combined inductive-deductive approach, with inductive beliefs acting as a factor to ground the research in reality, and deductive factors to ensure research is systematic to create valid and reliable research with testable outcomes. This combination of inductive and deductive reasoning is viewed by the researcher as the epistemological standpoint which is most secure to complete a valid research study.

4.1.4 Positivism and post-positivism

These standpoints are argued to be related to opposing points of the epistemological spectrum; positivism viewing knowledge as tangible, having an objective reality, and post-positivism holding knowledge as subjective. Positivism largely uses deductive and quantitative methods to provide objective evidence to support or disprove hypotheses (Cohen, et al., 2011). Kierkegaard amongst others (Holbrook, 1977; Roszak, 1970) emphasised the ability of each individual to consider themselves in relation to the world and the inevitable limits on understanding when applying general rules to the highly individual human experience (Kierkegaard, 2000). Cohen et al. (p. 19; 2011) notes that post-positivism would hold broadly nominalist views that the world is perceived by each individual and can only be understood from their viewpoint, typically with

the necessity of the researcher having some understanding of this individuals' interpretation.

Included within the post-positivist paradigm are naturalistic and interpretive schools of thought which hold that human beings create meaning through their activities and intentions; humans are individual agents motivated to respond by complex factors and experiences. Cohen et al. (2011, p. 11) critiques the positivist view when used to study social phenomenon which typically display layers of complexity which may not be tangibly measurable. Cohen et al. (2011) note that this is particularly relevant within school classrooms, noting that the complexities within this context for a purely positivist researcher present a "mammoth challenge" (Cohen, et al., 2011, p. 11).

As with all debate, there is a spectrum of viewpoints held within the definition of post-positivist thought, from the non-existence of universal realities to those who hold the view that there may be some truths which can be specific to individuals or groups (Kvale, 2009). This theoretical position holds that contexts are highly individual and require interpretation by the person experiencing them in order to gain the subjective truth. Any conclusions are therefore difficult to generalise and could be perceived in a number of different ways.

4.2 Research Design

The research design adopted by this researcher was a mixed methods design. This incorporated a post-positivist epistemology using quantitative and qualitative data to investigate the relationship between elements of PT and motivation as guided by theory. Within a naturalistic real world setting there are some limits on controlling for all extraneous variables, forcing the researcher to recognise the impact these may have on the outcome of the research. Assigning a post-positivist approach to real world research therefore appears most appropriate for this study as it has wider scope to capture the subtleties of interaction between participants and mechanisms in the environment.

The epistemological and ontological factors discussed has led the researcher to use the single-case experimental design research method. This provided the scope for elements of deductive reasoning whilst maintaining the inductive standpoint which highlights the individual experience of each participant. In

addition to this the researcher has identified complex factors relating to changing motivation and therefore has incorporated exploratory qualitative interviews to be analysed alongside the quantitative data within a sequential mixed methods design. “The purpose of this two-phase, sequential mixed methods study will be to obtain statistical, quantitative results from a sample and then follow up this data with a few individuals to explore or probe these results in more depth.” (Creswell, 2003, p. 101). In the first phase quantitative research hypotheses and single case experimental design methods address the potential impact of PT (independent variable) on the motivation of ten male pupils towards literacy. In the second phase qualitative hypotheses and interviews are used to probe and explore aspects of motivation with pupils who received a valid number of PT sessions to investigate the potential aspects of PT which could be impacting on motivation towards literacy. A realistic framework was utilised to provide a theoretical lens through which the qualitative and quantitative data were analysed and results evaluated (Creswell, 2003).

4.2.1 Realistic overarching framework

Unlike the element of proving direct causation which is central to the positivist epistemological view, realism explores the mechanisms at work within the action-outcome cycle, reviewing the mechanisms and specific contexts within which the outcome occurs (Robson, 2011). Within predominantly positivist methodologies, successionist models focus on ‘what works’. However realism provides a change in this emphasis, “from ‘what works?’ to ‘what is it about this programme that works for whom in what circumstances?’” (Pawson, Greenhalgh, Harvey, & Walshe, 2004, p. 2). In this way, realism can be linked with pragmatism, with conclusions of ‘truth’ based on evidence of what works (Robson, 2011). When exploring the ‘why’, the list of mechanisms and contexts within which the outcome should occur may be speculative (Pawson, et al., 2004), however they can also be built on previous research and previously established theoretical frameworks (Robson, 2011). Realism holds appeal for researchers working within applied and ‘real world’ settings as it focuses on understanding the mechanisms and contexts within which change happens,

allowing researchers to account for research contexts where it is highly unlikely that all extraneous variables can be controlled (Robson, 2011).

Within this research project, realist theoretical frameworks of motivation and the factors thought to induce motivation were used to explore how and why PT may have an impact on motivation and the mechanisms which may influence this change. Motivation is highlighted as the key variable to be investigated within this research project. Due to motivation being a broad and diverse concept, the researcher highlights aspects of self-efficacy (Bandura, 1977) and perceived control (Ajzen, 1985, 1991) as bringing key theoretical views to form the qualitative and quantitative data collection methods and interpretation of data, with pragmatic considerations also informing these aspects.

4.2.2 Mixed methods designs

Robson (2011) cites the following as typical features of a mixed methods research project:

- Quantitative and qualitative methods within the same research project;
- A research design that clearly specifies the sequencing and priority that is given to the quantitative and qualitative elements of data collection and analysis;
- An explicit account of the manner in which the quantitative and qualitative aspects of the research relate to each other and
- Pragmatism as a philosophical underpinning for the research. (Denscombe, 2008)

Multi-trait multi-method matrix as by Campbell and Fiske (1959) suggested gathering different forms of data on the same variable would increase the validity of the data (Campbell & Fiske, 1959, p. 104), highlighting any variation as likely to be caused by the variable and not by the data gathering method itself (Jick, 1979). Jick (1979) describes the combination of qualitative and quantitative methods as complementary and emphasises the use of these different strands of data gathering to validate data. Mixed methods research although a relatively new design is documented to be used across various fields including health services (O'Cathain, Murphy, & Nicholl, 2007), school

psychology (Powell, Mihalas, Onwuegbuzie, Suldo, & Daley, 2008) and sociology (Formby, 2013).

Criticism of mixed methods research is described as a result of distinct paradigms of qualitative and quantitative research which are not viewed as being able to be combined in a meaningful way. Robson (2011) refutes this by arguing that “paradigms are evaluated in terms of how well they square with the demands of research practice” (Robson, 2011, p.162). Bryman (2006) discusses the complexities of mixed methods or ‘multi-strategy’ research stating that timing of the two types of data collection can be difficult. Bryman (2006) indicated that mixed methods studies require a rationale which clearly indicates the overarching framework and the purposes of different methods of data collection.

4.2.3 Single case experimental designs

Typically single-case experimental designs (SCEDs) are used to investigate the effect of an independent variable over and above that of the effect of the typical context (Kratochwill, Hitchcock, Horner, Levin, Odom, Rindskopf, 2010). SCEDs have been used to monitor a variety of overt behavioural response changes to an intervention within clinical research (Nock, 2002; Sachs, 1973; Wetzel, Baker, Roney, & Martin, 1966). McCormick (1995) describes SCEDs as focussing on the effect of an intervention or independent variable on an individual participant, “As with traditional group experimental studies, the intent is to ensure that changes in the dependent variable are indeed the result of that intervention and are not a consequence of chance or other factors. Unlike most group-comparison experiments however, a basic tenet is that decisions about results are made by expressly delineating what has occurred with each individual in the investigation” (McCormick, 1995, p. 1). This marks the philosophical contrast between single-case experimental designs and group designs; the former focussing on tracking individual effects and the latter focussing on group effects and average performances. There are a number of types of SCEDs, including the reversal design (A-B-A), withdrawal (A-B), alternating treatments design (A, B1, B2, B3) and multiple baseline designs.

4.2.4 Rationale for multiple baseline research design

Multiple baseline single-case designs can be implemented across participants, settings or behaviours (Barger-Anderson, Domaracki, Kearney-Vakulick, & Kubina Jr, 2004b). Within a multiple baseline design, each participant takes part in a baseline phase, with intervention phases then introduced at staggered time intervals across the different participants, settings or behaviours. Confidence in the effect of the intervention is taken from the pattern of changes in behaviour corresponding to the staggered introduction of the intervention across participants (Kazdin, 2003), indicating that if a change can be observed in an intervention phase whilst another participants' continuing baseline phase does not show a change, this gives strength to the conclusion that the intervention has caused the change (Watson & Workman, 1982). Where corresponding baselines show similar trends, this adds evidence to the conclusion that it is likely other extraneous variables were not having an impact on these pupils during the period of the baseline and intervention.

Multiple baselines can be used in place of a reversal single-case design (ABA) through avoiding the ethical and practical implications of removing the introduced intervention during the reversal phase. Baer, Wolf, and Risley (1968) state that multiple baselines do not need to return to the baseline phase due to the extension of comparable baseline phases, arguing that an AB design is sufficient within a multiple baseline design to infer causality.

4.2.5 Repeated measures

Within any SCED design, repeated measures are used as a systematic measurement of changes of the behaviour being targeted by the intervention (McCormick, 1995). These repeated measurements are designed to take into account the variability of participant performance over time (Barlow, Nock, & Hersen, 2009) to provide a measure of each individual participants' trajectory during the intervention phase, thereby being "a natural consequence of an epistemology that conceptualises behaviour as a continuously unfolding phenomenon" (Kazdin, 2003, p. 642). Baer (1977) describes this repetition as an advantage of single-case designs over group designs, arguing that repeated

measurement constitutes a sound defence that any change or pattern observed between these data phases is highly unlikely to be produced due to chance.

4.2.6 Pre and post measures

When completing SCED research the focus is on charting changes in dependent variables using repeated measures. However to increase the reliability and validity of these measurements, commonly researchers combine pre and post measures with a repeated measure within the SCED design to support interpretation of the repeated measures data. The pre and post measure information provides a comparison of before and after the intervention is implemented, with the repeated measures data producing a measurement of the changes which occur over time.

Within this research the independent variable is the PT intervention, with the dependent variables being:

- Learning self-concept and self-efficacy of participants
- Perception of internal, unknown and powerful others attributions over learning outcomes as reported by participants
- Changes in attribution and locus of control as mechanisms of developing motivation

Measures which have been used to investigate changes in these dependent variables for pupils over the course of this research project are outlined in Section 4.6.

Within this research, quantitative and qualitative information has been gathered with the purpose of triangulating data in order to increase the likelihood that the collated data is representative of the active factors influencing motivation for the pupil participants. This research has used a combination of data gathering methods in an attempt to widen the scope of understanding of the factors impacting on motivation towards literacy of the participants in this project. Triangulation has been raised as a valuable component of research through its utility in increasing the confidence of the researcher that the data collected is not as a result of factors relating to the method of collection or source of the

data, but more reflective of the factors influencing the dependent variable under investigation (Banister, Burman, Parker, Taylor, & Tindall, 2001).

4.2.7 Interviews

Semi-structured interviews were used by the researcher to provide qualitative data within the mixed methods research design. The purpose of interviews within research can vary, providing information to test or develop hypotheses, gather experimental or survey data, and to sample respondents' opinions (Cohen, et al., 2011). Kerlinger (1973) also described that interviews could be used during research studies to explore participant responses and the reasons for these responses. The purpose of using interviews within the current study was to test hypotheses in conjunction with quantitative methods regarding the impact of PT on motivation towards literacy. The researcher generated an interview schedule designed to reflect the research questions identified by the research project (Banister, et al., 2001, p. 53). The interview schedule (see Appendix 10) incorporated probes to prompt pupil information, defined as "the systematic development of an everyday device used in conversation when one person is interested in precisely what another has to say" (Ziesel, 1984, p. 141). Addition, reflecting, transition, situation, emotion and personal probes were used as devices to probe but not lead an interviewee into elaborating on their discussion. Robson (2011, p. 284) advocates the use of probes to ensure rich data gathering within interviews.

4.3 Method

4.3.1 Stakeholders and their involvement

During the planning and implementation of this project, the Local Authority the researcher was working in had highlighted lower outcomes for students than the national expected achievement levels. This decrease in attainment was particularly evident in literacy and was highlighted as a priority focus for educational settings. As a result of this, PT as an evidence based intervention was felt to be a positive and relevant intervention to use to promote literacy skills for individuals in the authority. It was noted by the researcher that within the specific patch the researcher was working in, schools regularly referred Key Stage 2 male pupils who had become disengaged with literacy and their motivation towards this subject was further hampering their low attainment. Schools reflected that this was a relevant focus and were keen to investigate ways of improving student literacy through PT alongside reviewing any impact this may have on motivation towards the subject. Schools therefore worked with the researcher to identify pupils who would be suitable to take part in the project, with these regularly prioritised as being in Year 5 and 6 of Key Stage 2.

This research was completed as a doctoral thesis project during the researcher's study of Applied Educational Psychology at The University of Nottingham. The primary objective was to explore the impact of PT on motivation towards literacy for individuals vulnerable to low literacy outcomes and motivation towards learning.

4.3.2 Sampling strategy

The researcher used a purposive sampling strategy which refers to a population sample chosen specifically on knowledge of the population and for the specific purposes of the study. As a specific population was used for participant enrolment within this study, generalisation to populations other than the one used within the study was not required and therefore a purposive sample was suitable. Through use of the data gathered within the single-case experimental studies, some initial trends may be able to be made for a wider number of

individuals who fulfil the inclusion criteria applied to the population included in this project. However this would be highly tentative.

4.3.3 Population

Participants were gained from a population of male students attending schools within a geographical area within a Local Authority. These individuals all attended Year 5 or 6 in three mainstream primary schools within a Local Authority.

4.3.4 Inclusion criteria

To determine participants who would meet the purposive population sample, a number of criteria were created which participants were required to meet in order to be eligible to take part in the study:

- Male,
- Year 5 or Year 6 (aged between 9 years 5 months and 12 years 0 months),
- Attending a mainstream school within a 5 mile geographical radius in an English Local Authority,
- Staff highlighting concerns regarding literacy attainment. Literacy attainment was one or more sublevels below the national average for a child of their age within the literacy area to be targeted by the intervention,
- Staff identified them as de-motivated towards literacy learning through dis-engaged behaviour in literacy lessons (as defined by not reading for pleasure, increased distractibility in lessons and limited willingness to take part in literacy activities).

Pupil participation was then examined using a second exclusion/inclusion set of criteria (see Section 5.5) to review whether a viable level of PT input had taken place. As a result of this four students were included in the final interview phase and full data analysis.

4.4 Procedure

4.4.1 Initial contact with schools

On review of the initial focus of the project, initial discussions were completed with the link person across these schools (see Appendix 1), typically the Special Educational Needs Coordinator (SENCO). The researcher initially liaised with six schools following commonalities of feedback leading to creation of a potential research project. An initial sample of 10 pupils was identified by staff across three schools who volunteered to be included in the project through consultation of the initial inclusion criteria. Three schools responded indicating interest and further pragmatic details were discussed with either the head teacher or SENCO. Each meeting that took place followed the same agenda.

4.4.2 Staff training in intervention

The researcher devised and led the training (see Appendix 2) based on PT research and information (Raybould & Solity, 1982; Raybould & Solity, 1988; Roberts and Norwich, 2010) and PT training received by the researcher (Raybould, 2002). Staff across different schools received the same amount of training in Precision Teaching; however this was delivered in one session or over multiple shorter sessions depending on availability of staff. In school L, PT training was provided for the SENCO, head teacher and Y5 class-teacher as well as two teaching assistants. In other schools this training was only given to teaching assistants who were responsible for implementing the approach. The training included information on key elements of the Precision Teaching intervention; probes, aim rates and charting. The related hand outs provided for staff can be viewed in Appendix 3, 4 and 5.

4.4.3 SCED implementation

Each participant received Precision Teaching in the following pattern (for a full timeline please refer to Appendix 37):

A = Baseline phase. This extended from 3 to 6 weeks (excluding Easter Holidays) with the measure Multidimensional Measure of Children's Perceptions of Control (Connell, 1985) completed each week. No Precision Teaching was introduced during this time.

B= Intervention phase. This phase lasted between 6 to 8 weeks depending on each pupil's placement within the multiple baseline design. Precision Teaching was introduced during this phase.

Once each week the researcher visited the school to complete the repeated measure Multidimensional Measure of Children's Perceptions of Control (Connell, 1985) with each participant. The researcher actively initiated a routine of participant measurement which aimed to promote consistency in the day of the week and the time of day each participant was tested. This routine was consistent across the baseline and intervention phases excluding two occasions when this routine was transferred to the following day as a result of researcher/pupil unavailability. On each occasion the researcher administered the measure using consistent instructions as can be reviewed in the script included in Appendix 7. For some participants the location of administration of the measures changed, however every effort was made to ensure this location was free of distraction for the participant.

During the intervention phase on the weekly completion of the pupil measures, the researcher typically reviewed the Precision Teaching graphs for each participant. This was an attempt to ensure treatment integrity and support staff in correct implementation of the Precision Teaching strategies.

4.5 Intervention

The independent variable within this project was the implementation of Precision Teaching alongside literacy activities already in place for pupils. The literacy skills taught and teaching resources used within this research study were not identical between participants due to the differing literacy needs of each pupil. Consistency of the implementation of Precision Teaching was stipulated for staff within training delivered by the researcher.

After the initial Precision Teaching presentation, the researcher met with teaching assistants on an individual basis to discuss the pupils who would be involved in the research project and the area of literacy to focus on within the teaching sessions. Teaching Assistants were encouraged by the researcher to continue existing literacy interventions using resources held within school to formulate literacy activities during daily teaching sessions. The resources used by each Teaching Assistant in the teaching sessions during the baseline and intervention phases are listed prior to the description of participants' results.

Pupils received literacy input during the baseline in accordance with the schools current practice. Further resources and activities were also structured by this input during the Precision Teaching intervention phase, however Precision Teaching provided guidance on the application of this content and monitoring of progress as explained in the above information. The detailed context of each participant's literacy input is described alongside the data as contextual information. A timeline of data collection is included in Appendix 37.

4.6 Measures

Post-positivist theory holds that humans are not determined by universal laws because we are agents of change; humans exercise individual choices which cannot necessarily be determined by external forces and universal laws (see previous discussion about positivist and post-positivist thought) (Cohen, et al., 2011). This produces difficulties in defining observable and therefore measurable behaviours within human action that takes into account individual choice and intention. Proponents such as Chomsky (1959) highlight that this is made further difficult by human fallibility to correctly infer the stimuli which affect behaviour. This is extremely relevant to the measurement of motivation as a dependent variable; not only is the concept of motivation multi-faceted, post positivist theory indicates that each individual may respond differently as a result of changes in motivation due to the potential mechanisms at work. Measures were therefore chosen to review motivation and the inter-related factor of perceptions of the pupil on their own ability as a learner.

Pre and post measure

A pre and post measure of self-efficacy within learning was completed by the researcher. The Myself-as-a-Learner Scale (Burden, 1998) is a 20 item scale and can be used for pupils between 9 and 16 years of age. The items within this measure are rated statements relating to the individual's perception of themselves as a learner and problem solver. This scale was completed by the pupil at the beginning of their baseline phase and after the intervention phase, and was read to pupils if there were queries about reading ability. The MALS is reported to show concurrent validity of 0.001 significance with the unknown cognitive control, control by powerful others and internal cognitive control

aspects measured by the Multidimensional Measure of Children's Perceptions of Control (MMCPC) (Connell, 1985). The researcher also completed some additional feedback with the staff on the pupils they had completed the Precision Teaching sessions with (see Appendix 9).

Repeated measure

During the baseline and intervention phases, repeated measures of motivation were taken as required within a SCED. This was based on a selection of items from the Multidimensional Measure of Children's Perceptions of Control (MMCPC) (Connell, 1985) which asks students to rate their responses to questions relating to their perceived sense of control in cognitive, social, physical and general domains. Internal consistency calculations for the cognitive domain items indicated correlation between items through alpha coefficient values for unknown (0.67), powerful others (0.59) and Internal control (0.56) (Connell, 1985). Whilst the generally accepted Cronbach's alpha reliability coefficient value is above 0.7 (Nunnally, 1994), it should be noted that the small number of items within each domain may have an adverse effect on the coefficient value (Pallant, 2005), therefore this alpha coefficient was reported to display fair reliability within items in the cognitive scale.

There has been some indication that the MMCPC measure shows low construct and divergent validity (Marsh & Gouvernet, 1989), however it is further described that divergent validity of the different domains is low, but divergent validity of the internal, unknown and external causes within each domain is satisfactory (Connell, 1985; Marsh & Gouvernet, 1989). The statements refer to the attributions made by the responder when experiencing failure and success in these domains. The 12 cognitive statements were taken from the MMCPC questionnaire and repeated each week. These statements were chosen as they referred to the cognitive domain which was most relevant to the research questions, where social, physical and general domain statements were irrelevant. In the original version of the MMCPC, the statements were filled out by pupils ticking a box to indicate their response to each statement.

It was felt by the researcher that changes needed to be made to the response mode in order for the measure to be more engaging for the participant and to

ensure randomisation of the statements on each occasion the measure was completed. The researcher created 12 laminated cards on which were printed one of the 12 statements from the MMCPC. The researcher also created a board on which were attached four response envelopes labelled “Not at all true”, “Not very true”, “Sort of true” and “Very true” matching the responses in the original questionnaire format. Participants were requested to place each statement in the envelope which they felt best matched their response that week. A consistent script was used each week to instruct the participant on the measure (see Appendix 7).

The researcher also considered the development of a measure of staff perception of pupil motivational change in order to further triangulate data. Three items from The Questionnaire for Identifying Behavioural Problems Associated with Maladaptive Motivational Style (Leo & Galloway 1994) were considered; these statements focussed on mastery motivation, learned helplessness and self-worth motivation (see Appendix 8).This was piloted and used during the research study. However a very high number of missing data points led the researcher to feel that analysis of the data would be invalid and not add to the conclusions of the study. In addition staff reflected that the questions were too broad to capture subtle changes in behaviour, and that they were unsure that their observations of behaviour captured pupil motivation accurately. It was therefore discontinued as a measure.

4.7 Pilot study

As the repeated measure (MMCPC) took statements from a pre-existing questionnaire and the current study was implementing them in a novel way, the researcher felt it would be valuable to the validity of the measure to complete a pilot study. The purpose of this was to ensure the statement content and the response method of completing the measure could be understood by this age group. The pilot study also completed the pre and post measure (MALS) with pupils to ensure that the statement content could be understood by this age group. This took place in a school which was in the geographical location of the schools of participants taking part in the research study. The pilot study was completed with ten Year 5 participants. The data from the measures completed in the pilot study are not included in the overall data analysis of the project, but

responses from students on their understanding of the measures influenced how measures were undertaken in the study (see Appendix 11 and 12). Pupils reported no difficulties understanding or completing the measures.

4.8 Reliability and Validity

Barger-Anderson, Domaracki, Kearney-Vakulick and Kubina (2004a) describe that the impact of an independent variable within a multiple baseline design can only be concluded where measures have been taken within that design to ensure internal and external validity and control replication. Cohen, Manion and Morrison (2011) describe that "the fundamental purpose of experimental design is to impose control over conditions that would otherwise cloud the true effects of the independent variables upon the dependent variables" (Cohen, et al., 2011, p. 155). Internal validity refers to measures taken to determine whether the treatment or intervention has made a difference to the dependent variable, and external validity refers to the extent to which the research can be generalised to wider populations and whether the research is designed in such a way that it measures what it sets out to measure (Cohen, et al., 2011). Validity and reliability are also important within qualitative data gathering, with 'trustworthiness', 'authenticity' and 'credibility' of the data being the aims of qualitative researchers (Creswell, 2003, p. 196)

4.8.1 Validity and reliability issues within the current study

As this research project was set within a real world research setting (Robson, 2011), the researcher acknowledges the quantitative and qualitative data gathering within the mixed methods design would be unable to control for every variable which may impact on the validity and reliability of the data. The following threats to these elements were considered prior to the research beginning.

<u>Internal validity</u>

Variables in the environment of each participant may have changed and have an impact on their performance between the start of the baseline phase and end of the intervention phase of the research project. The impact of this history

on the participants' performance could be mistakenly attributed to the effects of the independent variable. Although pre and post tests were used in the current study, the single-case design allowed the researcher to take regular data points from each individual therefore increasing the likelihood that small changes in performance across the study timeline would be observed. In addition due to the increased presence of the researcher having contact with the participants as opposed to a pre and post-test design, this allowed for the researcher to be notified of any environmental changes for each participant which may have impacted on their performance. Maturation is also a threat to internal validity, this being the natural development of skills during the project which have an impact on performance in the measures. To control for this, the researcher attempted to ensure the repeated pupil measure (MMCPC) was specified to responses regarding literacy learning. A multiple baseline was also planned to attempt to administer the intervention over extended periods of time in an attempt to increase the likelihood that treatment effects impacted pupil performance rather than maturation or history.

Statistical regression may also have an impact on the data in this research, indicating that scores particularly on the pre and post-test measure may regress to the mean, with the potential of the researcher attributing post-test higher scores to an overall low score and vice versa. This is a particular threat to validity following repeated testing (Kazdin, 2003). Testing effects are also relevant to this research study, with the repeated weekly test potentially prompting practice effects. In order to control for the effects of testing, the researcher developed an innovative method of completing the repeated measure. This was developed with pupils through the pilot study and utilised a method which resulted in the twelve statements being presented randomly on each occasion they were used with each participant. The mode of response was also designed to be novel for the pupil in order to promote attention and motivation to engage with the measure. Internal validity can be improved by waiting for stability of the data within the baseline phase and ensuring consistency of the intervention implemented. Consistency of implementation of Precision Teaching was ensured through observation of initial PT sessions by the researcher and a further validity measure where a session was observed

and the researcher gave feedback to the Teaching Assistant regarding any changes that needed to be made to ensure fidelity to the Precision Teaching intervention (see Appendix 13 for a pro-forma of this checklist).

When using qualitative data Creswell (2003) describes that accuracy and credibility of findings is crucial to their validation. Within the present study the researcher used participant checks and audio recording to ensure that the interview data was accurately recorded. Specifically checks were planned for interview transcripts to be checked for accuracy by an independent judge. In addition the researcher acknowledges the bias which can influence qualitative data analysis. In order to address these biases, visual analysis of the single-case experimental design data was reviewed by a number of colleagues independent to the study. Thematic analysis of the pupil interviews were also checked by inter-raters. Within the data analysis and discussion, efforts have been made to give a "thick description" of participants and their contexts in order to convey the reasons for the conclusions reached (Creswell, 2003, p. 196). Within this study both qualitative and quantitative measures have been used to examine information on the dependent variable. Triangulation of this data has been used to strengthen the validity of the conclusions drawn through creating a coherent set of themes within data analysis which combine common themes within the data strands.

External validity

The researcher acknowledges that the single-case designs within this research study are less concerned with generalizability than would be the case for a group experimental design. However replication of the cases described in this study could enable replication thereby increasing the potential generalizability of the findings of the current study. Therefore all attempts have been made by the researcher to give a clear description of the interventions in place within the current study to support any future replication. Replication can be improved by matching eligible participants by characteristics to ensure that there are minimal differences between the participants studied.

Reliability

Motivation as previously discussed is a multi-faceted construct which leads to complexities in reliably measuring it. Triangulation of research measures was one method by which the researcher gathered information on this construct within this study to promote reliability of the data. Triangulation of perspectives reduced the impact of observer bias which may be present. The researcher acknowledges that reverse participant bias may have impacted pupil responses to the repeated measure through the repeated nature of the measure leading to some occasional indications of disaffection from pupils. The standardised measures of the MALS and MMCPC were considered by the researcher to be satisfactory in their measurement of self-efficacy and attributions of control which as have been discussed are factors which have been linked to the construct of motivation.

4.9 Ethical considerations

A proposal was made to the ethics committee at The University of Nottingham and approved (see Appendix 39). Further alterations to the study were re-submitted to the chair of the ethics committee who approved these changes. The following ethical considerations have taken into account the guidance available to psychologists to guide ethical research practice. This includes the British Psychological Society (BPS) guidance within the Code of Human Research Ethics (2010) and the BPS Code of Ethics and Conduct (2009). The researcher has also taken into consideration the ethical principles and guidance contained within the HCPC guidance for practitioner psychologists (2010) and guidance on conduct and ethics for students (2009).

4.9.1 BPS Principles of Ethical Research

4.9.1.1 Respect

Students within this study could be seen as vulnerable in that they are not meeting the learning levels typically expected for someone of their age. They could therefore be feeling that their confidence is undermined and therefore be vulnerable to further failure. It was made evident to staff, parents and pupils that participation in this project is voluntary and that they are free to withdraw at any time. The right to withdraw is clearly set out in the parent, pupil and staff information sheet, and each member of staff, parent and pupil also indicated

their understanding of this right to withdraw within the consent form. Pupils were regularly asked if they would like to continue, and informed during measures that they did not have to answer questions if they did not wish to. Consent was gained from parents followed by the pupil themselves. The information provided (see Appendix 14 and 15) includes as much information as possible in language appropriate for the reader. An information sheet was also provided to the school teaching assistant (see Appendix 16).

All participants were provided with the contact details of the researcher and research supervisor and were encouraged to make direct contact should there be any queries or concerns raised. It was discussed with staff that should a pupil become distressed by the process, this should be taken as an indication that they no longer wish to participate in the intervention and research. In the event of this their data monitoring would be discontinued, with their data not included in the study. In addition to this when the researcher extended the study by completing interviews with target pupils, audio recordings of the pupils were made only with their parent/carer's expressed permission and informed consent of pupil and parents (see Appendix 17 and 18).

Competence

The researcher ensured she reviewed the BPS guidance on conduct and ethics (2009) throughout the thesis project to ensure the practice within the project met the high standards of competence required. These guidelines were also used to recognise any ethical difficulties which arose and engage in a process of ethical decision making identified in the Code (BPS, 2009). The researcher also received regular university and placement supervision during the research project acknowledging any limits to professional practice as a TEP, and gaining support for the process of recognising limits to skills, knowledge and training. The training provided to schools on Precision Teaching followed evidence based intervention guidance provided to the researcher and therefore promoted ethical practice in putting into place the best methods known to support the area of learning targeted by this research project.

Responsibility

Staff were consulted regarding the suitability of this programme for the pupil. If at any point during the intervention, staff felt the intervention was inappropriate for the student, they were encouraged to discuss this with the researcher in order to review whether this pupil should be removed from the intervention. Debrief materials were provided for pupils, staff and parents following their participation in the research study (see Appendix 19 and 20). Details which could affect the confidentiality of pupils or staff participating in the project were kept securely and coding used wherever possible. Potential methods of coding were discussed within supervision and confidentiality of pupil information was achieved throughout using a coding system chosen by the researcher. Weekly data from each participant was recorded using this anonymous coding system, which was known only to the researcher. The researcher was granted full CRB disclosure for her research practice. During the extension of the project, interviews were recorded using an audio recorder in order to support valid and reliable data analysis. Transcripts of these audio recordings were created by the researcher and checked by professional peers. Following the checking of the accuracy of these transcripts the direct audio recording was destroyed to prevent any inadvertent identification of participants. This was based on guidance sought from the ethics department at the Department of Psychology at The University of Nottingham.

Integrity

The purposes and procedures of the research study are clearly set out within the information sheets provided to staff, parents and pupils (see Appendix14, 15 and 16). This attempts to ensure that participants are fully informed about the research purposes and measures, with pupils, members of staff and parents having the opportunity to put questions to the researcher to clarify any points. This study did not offer any monetary reward for students or parents for participation in this study. However due to a change in the Local Authority Educational Psychology Service delivery, schools received a free allocation of EP time, and were required to pay for further EP input. As this study is part of the researcher's doctoral training it was offered free of charge, therefore meaning that schools who would otherwise be required to pay for the EP input they were receiving the time for free. To ensure integrity, schools within the

area were given an equal opportunity to take part, and the researcher worked with all schools who indicated an interest.

A key ethical consideration concerned in the research design was regarding the length of baseline and intervention phases within the SCEDs. In this study the researcher did not feel it was ethically or practically viable to provide the Precision Teaching during the intervention phase and then remove it to review the impact of the intervention. Due to this a multiple baseline design was attempted. This resulted in the baseline for some participants being longer than others. However the baseline was not longer than 6 weeks and students were receiving literacy intervention during this time without the Precision teaching.

5 Results

5.1 Introduction

This chapter provides background information on options for data analysis within single-case designs. The chapter then proceeds to define the data analysis methods used within this paper and the rationale for this. A description of the participants and their individual results is followed by an overview of some common trends drawn from the data.

5.2 Statistical Analysis of Single Case Experimental Designs

Statistical data analysis techniques typically used within group designs are arguably based on a set of criteria which are different to those underlying single-case designs (Barlow, et al., 2009), including assumptions of typical population distribution and independence of data points. Baer (1977) describes that single-case data are not based on the independence of data assumptions which seem necessary for parametric statistical analysis of data to ensure Type 1 errors[4] are avoided (Baer, 1977, p.172). Therefore a number of non-parametric effect size tests have been increasingly used in single-case design research (Brossart, Parker, Olson, & Mahadevan, 2006; Parker, Vannest, & Davis, 2011). Advantages of statistical tests are cited as raising validity of effect conclusions (Ferron & Foster-Johnson, 1998), and providing a method to compare N=1 designs within meta-analyses (Solanas, Manolov, & Onghena, 2010). However it is argued that statistical tests providing indications of probability are prone to Type 1 errors due to autocorrelation of data (Matyas & Greenwood, 1990).

Interrupted time-series analyses are a statistical analysis option within single-case designs, however these typically require over 50 data points (Barlow et al, 2009) which is challenging for small-scale real world researchers to achieve. Visual randomisation tests (Ferron & Foster-Johnson, 1998) are also a

[4] Type 1 error refers to rejecting the null hypothesis and incorrectly assuming significant differences that would not be present in the wider population (Kazdin, 2003; Pallant, 2005). In contrast with Type 1 error, Type 2 error refers to concluding there is no difference between data in the research sample when in fact a difference is present (Pallant, 2005; Robson, 2011).

consideration, however they require randomisation of data which can be practically restricted within real world research.

Wider debate argues against the use of statistical tests within single-case research, stating that any effect should be visually observable through the mechanism of plotting single-case data on a real-time graph. (Michael, 1973). However others have argued that current single-case research is increasingly interested in smaller indications of intervention effects, and that statistical analyses such as effect sizes provide greater objectivity, precision, certainty and wider comparability of single-case data (Parker, Vannest, & Brown, 2009) In contrast to group designs using effect sizes, single-case designs typically measure variation and amount of overlap between baseline and intervention phase data to provide a magnitude of effect measure (White, Rusch, Kazdin, & Hartmann, 1989).Statistical methods of analysing SCED data have become more prominent in recent years (Kazdin, 2003) and are suggested to be supplementary to visual analysis (Brossart, et al., 2006; Harbst, Ottenbacher, & Harris, 1991), although no statistical approaches have been consistently applied.

5.3 Visual Analysis of Single case Designs

Creating a visual graph is the typical data presentation and analysis method used within single case experimental design research (Barlow, et al., 2009; Kazdin, 2003). This visual depiction of data over time is typically used to review the presence of a relationship between the independent and dependent variables, alongside concluding the strength of this relationship (Barlow, et al., 2009; Kratochwill, et al., 2010) through evaluating the effect of an independent variable in comparison with this participant's own baseline (Kazdin, 2003).

Despite the prevalent use of visual analysis within single case research, it has received some criticism around its vulnerability to Type 1 and Type 2 error (Matyas & Greenwood, 1990). An inverse relationship occurs between Type 1 and Type 2 errors, such that as the likelihood of making a Type 1 error decreases, there is a corresponding increase in the likelihood of making a Type 2 error (Robson, 2011). Identification of a weak treatment effect is less likely to occur through visual analysis (Baer, 1977) which may indicate visual analysis is

vulnerable to Type 2 error (Ferron & Foster-Johnson, 1998). Research has also indicated evidence of poor inter-rater reliability within visual analysis (Harbst, et al., 1991), with some researchers claiming the lack of agreed references used to interpret graphs as a potential reason for the lack of inter-rater agreement (Furlong & Wampold, 1982).

This has led to increasing calls to define further stringent and agreed descriptive numerical techniques by which to analyse within and between phase effects (Kratochwill, et al., 2010; Morley & Adams, 1991). Systematic examination of data within and between conditions through changes in level, trend and variability of performance are increasingly used to support SCED analysis (Horner et al., 2005).

Percentage of non-overlapping data between baseline and intervention phases has been used to determine the effect of an independent variable (Scruggs, Mastropieri, & Casto, 1987), although lack of reliability of this calculation with low numbers of data points and the effect of extreme outliers on the calculation creates limitations to the approach(Allison and Gorman 1994). The percentage of all non-overlapping data (PAND) calculation (Parker et al., 2009) attempts to control for these criticisms by including all data points within phases. However Parker et al. (2009) describes that this calculation is not suitable for use with data sets which include less than 25 data points.

Kratochwill, Hitchcock, Horner, Levin, Odom, Rindskopf and Shadish (2010) discuss that to evidence that a relationship is present between an independent and outcome variable, and to indicate the level of strength between these variables, SCED researchers must clearly demonstrate an effect within the documented data of the study using systematic and consistent values of analysis. These elements are described below:

Table 5.1 Table of analysis factors to support graph visual analysis as described by Kratochwill et al. 2010.

Analysis factor	Phase data explored	Description	Outcomes
Level	Within phase data.	Mean (average) score in data points within each phase. Mean shift can be calculated through analysing the percentage of mean changes between phases (Harbst et al. 1991)	Where the mean score is higher or lower between the baseline and intervention phases, this indicates a difference between the baseline and intervention phase data. Higher mean shift scores indicate higher levels of change between phase means.
Trend	Within phase data.	The line of best fit of the data in the baseline and in the intervention phase. These lines also indicate where the data would be projected to be.	The line of best fit should be level in the baseline phase to indicate stability of the data (Barlow et al. 2009). The trend line in the intervention phase indicates an increasing, stable, or decreasing data trend.
Variability	Within phase data	The range of scores and standard deviation of scores around the trend line.	Where the standard deviation and variation values are low, the data values are more tightly packed around the

			average score, indicating a data set which has higher stability. This is potentially indicative of a more reliable data set within a phase.
Immediacy of effect	Between phase data	Indicates the change in the mean score of the last three data points in the previous phase in comparison with the mean score of the first three data points in the next phase.	If the data points at the start of the intervention phase are different to those in the baseline phase, this may indicate an immediate effect of the intervention.
Overlap	Between phase data	Indicates the amount of overlap between the data points in one phase and the next phase.	The smaller the overlap between data points in the different phases, the greater the indication of an effect. The less overlap between data points in the baseline and intervention phases, the greater the indication of a change between the data in phases, which could indicate an intervention effect.
Consistency of effect	Between phase data	Reviews the consistency of phase data with data	Within AB data sets, this is not possible to

		of other identical condition phases.	calculate due the number of data phases not being large enough to indicate consistency of data (Kratochwill et al. 2010).

Kratochwill (2010) suggests that there are four stages in the visual analysis process which are as follows:

1. Review the baseline phase (A) to review whether there is a predictable pattern of behaviour and whether the data indicates a behaviour in need of change.
2. Assess the level, trend and variability within each data phase, and compare this with adjacent data phases.
3. Compare the overlap, immediacy of effect and consistency of data patterns in similar phases.
4. Review all analysis factors to see whether there are three or more points which demonstrate an effect at different points in time across data phases.

(These stages of visual analysis have been adapted from Kratochwill et al., 2010)

5.4 Data analysis procedures used in the current study

5.4.1 MMCPC data analysis

In order for the SCED data to be analysed, the researcher created graphs of the data points using Microsoft Excel (Carr & Burkholder, 1998; Dixon, Jackson, Small, Horner-King, Mui Ker Lik, Garcia, 2009). These graphs plotted total pupil ratings for unknown, powerful others and internal control from each data collection point as individual data points. Total values were plotted as average ratings were not sufficient for visual analysis as the steps between data points were extremely small. Visual inspection of these graphs was then completed

using the Kratochwill et al. 2010 analysis factors of level, trend, variability, immediacy of effect and overlap outlined previously. Additional numerical values were also calculated to provide wider detail to support analysis of any intervention effect. Further statistical analysis was decided against due to the limited data points in the present data sets.

The effect size provided by calculation of the Improvement Rate Difference (Parker, et al., 2009) has been described as the difference in improvement rates between the baseline and intervention phases.. It is argued to provide a sound alternative to other effect size calculations such as R^2 and Cohens *d* (Parker, et al., 2009) and has been used within single-case research (Vannest, Harrison, Temple-Harvey, Ramsey, & Parker, 2011) . IRD has been indicated to be able to distinguish amongst the lowest 10% of effects (Brossart, et al., 2006) and is calculated using the procedure outlined below:

$\frac{\#impr.}{\#total}$ = Improvement Rate (IR)

*where #impr. indicates the minimum number of data points which would need to be removed from the phase data to eliminate overlap between phases, and #total indicates the total number of data points in the phase.

Improved data points are analysed visually. An improved data point in the baseline is one which ties or exceeds any data point in the treatment phase. An improved data point in the treatment phase is defined as one which exceeds any data point in the baseline phase (Parker, et al., 2009). Within the current study Phase A and Phase B improved data points were reviewed to calculate improvement rate. The following calculation was then completed to find the Improvement Rate Difference:

Phase B IR - Phase A IR = IRD

The maximum IRD score is 1.00, indicating a 100% improvement in data points in the intervention phase than in the baseline phase. IRD scores of 0.5 or below indicate any difference is present by chance, 0.5 - 0.7 indicate a moderate effect size, and effects rated as large are IRD scores over 0.75 (Parker, et al., 2009).

The remaining numerical elements used to analyse data within this paper are described in full in the table below.

Table 5.2 Numerical data analysis measures used in the current study

Variable	**Numerical contribution to analysis**
Level	The mean difference between the level in one phase and level in the next phase (mean change) will be calculated by subtracting the mean from Phase B from the mean from Phase A (Harbst et al. 1991) An increased number indicates an increase between Phase A and B mean ratings. To calculate the percentage of change between these phases (mean shift) the Phase A mean will be subtracted from the Phase B mean and the difference divided by Phase A mean (Harbst et al. 1991).
Variability	Standard deviation will be calculated and described for both baseline and intervention phases.
Immediacy of effect	Comparison of the last data value in Phase A and first data value in Phase B (Harbst et al. 1991), to give a tentative review of increase or decrease in ratings between phases.
Overlap	The total number of overlapping data points was calculated through eyeballing the data and completing the following calculation: Number of overlapping data points/Total number of data points × 100 = % overlap. Effect size was calculated as a product of the non-overlapping data points within the improvement rate difference (IRD) calculation (Parker, et al., 2009; Parker, et al., 2011).
Trend	The formula used to create the linear trend line for each factor graph equates to y=mx+c where m indicates the slope of the known x and y graph variables. This slope value will be included within the numerical information to provide an indication of slope gradient to supplement the visual analysis.

5.4.2 Inter-observer agreement

Inter-rater reliability checks were made of the visual inspection completed by the researcher. This was in order to promote accuracy of the data analysis and conclusions drawn. Nine people (including trainee Educational Psychologists (EPs), EP colleagues and university graduates) were asked to review the graphs and provide their judgement on the presence and significance level of any observable changes within the data. In visual analysis for data to propose "strong evidence", Kratochwill et al. (2010) argue that at least two inter-raters must identify a causal relationship between data phases. "Moderate evidence" is demonstrated by three observed effects with the possibility of at least one demonstration of a non-effect. Kratochwill et al. (2010) argue that "no evidence" can be claimed where three demonstrations of an effect are not observed. Brossart, Parker, Olsen and Mahadevan (2006) describe that inter-rater judgement of single-case graphs should be rated on the level of confidence a judge has about the effect of the intervention after observing the data. These criteria were used by the current researcher through showing each inter-rater the level, trend, variability, overlap and immediacy of effect graphs, and giving instructions to give their agreement rating to confidence statements. Raters were advised to identify a significant change where they rated that three or more elements demonstrated this (see Appendix 34 for example inter-rater script).

Although there is a precedent within research to use an average judgement rating, the researcher felt that this eliminated the variability in scores, thereby making the analysis insensitive. Fleiss' kappa was therefore identified as a further development of the Cohen's Kappa calculation to ascertain inter-rater agreement between more than two raters (Fleiss, 1971). This is a statistical measure which calculates the level of agreement between more than two rater judgements, which identifies the level of agreement over and above that expected by chance. The value produces scores between 0 and 1, with 1 indicating total agreement between raters. Fleiss Kappa was designed for many inter-rater observers (Fleiss, 1971). Review of this statistic indicates that it can be highly sensitive and therefore produces overly cautious reliability statistics (Falotico & Quatto, 2014).

The following calculations are used to calculate Fleiss' Kappa (K):

$K = \frac{Pa-Pe}{1-Pe}$

The following sub-calculations are also used:

$Pe = \sum_{j=1}^{k} q \frac{2}{j}$

$Pa = \frac{1}{N} \sum_{i=1}^{N} Pi$

When interpreting Fleiss Kappa values, a general standard has been proposed by Landis and Koch (1977) as follows:

Less than 0 = Poor agreement
0.01-0.20 = Slight agreement
0.21-0.40 = Fair agreement
0.40-0.60 = Moderate agreement
0.60-0.80 = Substantial agreement
0.80-1.00 = High/perfect agreement
(Landis and Koch, 1977, p.165)

These benchmarks are used within a wide range of research (Afzal & Robinson, 2009; George, Rutley, & Walsh, 2008; Nordahl, Krølner, Páll, Currie, & Andersen, 2011), and therefore have been applied in the current study.

5.4.3 Reliable Change Index

The Reliable Change Index (RCI) calculation (Jacobson, Follette, Revenstorf, Hahlweg, Baucom, & Margolin, 1984) was used to analyse how much change occurred between the pre and post Myself as a Learner Scale (MALS) data in the present study. The RCI index has been recommended for use with pre-test post-test measures (Speer & Greenbaum, 1995) specifically as it takes the instrument reliability into account (Hageman & Arrindell, 1993; Speer, 1992), and has been used within single-case designs (Blackwell & Holmes, 2010; Lundervold & Belwood, 2000). Reliable change provides evidence of a significant statistical change however this is not equivalent to a significant clinical change and it remains necessary to analyse further data to identify evidence of clinical change.

Christenson and Mendoza (1986) made some alterations to the original RC index, and proposed that it could be completed using the following formula:

$$\mathrm{RC} = \frac{\mathrm{x2} - \mathrm{x1}}{Sdiff}$$

Jacobson and Truax (1991) describe that a RCI calculation yielding a result of 1.96 or above would indicate a reliable change of scores, with a highly unlikely chance ($p<0.05$) of an RCI score of 1.96 or above occurring without actual change between data points.

The RCI calculation was used to analyse the reliable change index statistic for each participants' pre and post intervention score on the Myself as a Learner Scale (MALS) (see Appendix 38 for a full review of RCI calculations).

5.4.4 Thematic Analysis

Thematic analysis has been used within this research project to analyse the interview data provided by each included participant after the intervention phase had ended. Thematic analysis is described as, "a method for identifying, analysing, and reporting patterns (themes) within data" (Braun & Clarke, 2006, p. 6), and is a process used to analyse qualitative information (Boyatzis, 1998).Thematic analysis identifies patterns within data and seeks to organise this information to allow for interpretation of common or diverging themes (Boyatzis, 1998). For this reason, thematic analysis was chosen by the researcher to identify themes within the data in an attempt to organise and interpret the potential mechanisms affecting the motivation outcomes for participants in this study.

Each interview was analysed individually following the procedure below:

1. Becoming familiar with the data. In this instance this was achieved through transcription of recorded interviews.

2. Generating initial codes. As indicated above this was completed using a theory-driven approach.

3. Searching for themes within the data set.

4. Reviewing themes to ensure coded data and theme labels reflect a consistent pattern.

5. Defining and naming themes through inter-rater checks.

6. Narrative description of data.

This process has been adapted from Braun and Clarke (2006).

Boyatzis (1998) describes three methods of developing code within thematic analysis: theory driven, prior data or prior research driven, or inductive as taken from the raw data. The researcher analysed the raw data using theory driven code, as linked to the motivation research base and theories of motivation used within other measures and the literature review in this paper.

The researcher derived a theory-driven code following the process below:

Stage 1: Generating initial themes through contemplation of theory and previous research findings.

Stage 2: Checking compatibility of these themes with the raw interview data gathered.

Stage 3: Determining the reliability of coders and the code through inter-rater checks.

These stages have been adapted from Boyatzis (1998).

The theoretical code was developed through review of motivational theories described in the literature review of this paper; these included attribution theories of motivation (Kelley, 1967; Weiner, 1979, 1985) social learning theories (Lewin, et al., 1944; Rotter, 1990) and achievement theories (McClelland, et al., 1953). Overall themes of attribution theory, social learning theory and achievement motivation theory were therefore used. The purpose of developing a theoretical code using these elements was in order to incorporate

motivation elements which were common across the theoretical discussion surrounding motivation, and elements which have an evidence base. The researcher hypothesised from the research evidence on motivation, that elements of perceived loci of control, social norms and experiences, and individual attitudes could act as mechanisms to impact motivation in the current study. Specifically attributions were analysed in line with developments within attributional theories (Weiner, 1979) labelling elements of aptitude as stable, internal but uncontrollable; temporary effort as internal, unstable and controllable; long term effort as internal, stable and controllable; fatigue/environmental elements as external, unstable and uncontrollable; and chance causation as unstable, external and uncontrollable (Weiner, 1992, p. 250). These elements were therefore used to create sub-themes from which coding of the data was undertaken. The initial thematic map as drawn by the researcher is included in Appendix 25. In addition, Appendix 25 includes a combined list of themes, sub-themes and codes used to analyse interview data. Each pupil's interview data was analysed individually, and therefore although themes and sub-themes remain consistent, codes differed according to the data within each interview.

The researcher acknowledges the increased vulnerability of theory-driven analysis to researcher bias (Boyatzis, 1998). However flexibility was maintained in the developed themes to ensure its application to the data sets, and validity of the data was promoted using inter-rater checks. Inter-raters were provided with information to explain the definitions of the sub-theme titles used by the researcher. Adjustments were made following inter-rater feedback to change allocation of data to sub themes and adjusting the theme and sub-theme titles to reflect the data more accurately. Inter-raters agreed with approximately 85% of the data allocated within the sub-themes. Inter-raters also indicated their level of agreement regarding the sub-theme title and data within that sub-theme for each participant. Where inter-raters queried the suitability of titles and the data within the theme, a discussion was undertaken to agree a more suitable title. This was required for no more than ten percent of the sub-theme titles for each participant.

5.5 Multiple baseline process

Typically multiple baseline analysis reviews the baseline stability of all participants, and the overall changes between participants' baseline and intervention phase data, to conclude the presence of a change due to the intervention (Barger-Anderson, et al., 2004b). Kazdin and Kopel (1975) state that a multiple baseline design should include four or more baselines to promote accurate observations of any changes in behaviour as this is more likely to make clear the effect of any generalised changes occurring which are impacting on the intervention outcomes. Kazdin and Kopel (1975) note that collecting baselines across different individuals and situations contributes to the validity of inferences drawn between the intervention and changes in behaviour due to the fact that these cases are likely to be highly independent therefore strengthening the conclusion that the intervention is having an impact despite generalised changes outside the research design.

Within this research study, ten participants were initially included. The rate of PT sessions was calculated as the average number of sessions conducted per week. Below three consistent sessions a week is considered as insufficient frequency from which to draw valid conclusions about the impact of PT (Raybould, personal email, 2014, see Appendix 35). To promote validity in the conclusions drawn from this study, the researcher considered that for pupils who did not receive this number of sessions, the PT would not have had adequate time to make any impact on pupil progress or motivation, thereby invalidating the analysis of their single-case data. This exclusion criteria was applied to participants, and Pupil A, B, C and D were determined to have received adequate input as outlined in the table below.

Table 5.3 Rate of Precision Teaching sessions for pupils within the research project.

Pupil	No. of sessions completed	No. of intervention weeks available	Rate of PT sessions per week (no.of sessions/no. of

			PT weeks
Pupil A	29	8	3.6
Pupil B	29	8	3.6
Pupil C	28	8	3.5
Pupil D	20	5	4
Pupil F	12	5	2.4
Pupil G	13	6	2.1
Pupil E	18	7	2.5
Pupil H	13	5	2.6
Pupil I	16	7	2.2
Pupil J	10	6	1.6

The variation in the number of PT sessions received by participants is argued by the researcher to severely compromise the conclusions regarding overall group comparisons of change between baseline and intervention phases. This comparison was therefore not completed. However the baseline phases of all participants were analysed for stability as a key factor of multiple baseline designs is establishing a pattern of stable baselines (Hawkins, Sanson-Fisher, Shakeshaft, D'Este, & Green, 2007),

The purpose of completing a multiple baseline analysis in this paper therefore was to promote the validity and reliability of the intervention data through comparison of the stability of baselines over different time periods. The staggered times the interventions were introduced to participants (see Appendix 37) is proposed to add some strength to conclusions about the effect of time-related extraneous variables such as history and maturation for intervention phases of pupils who had received adequate PT (Pupils A, B, C and D). This baseline analysis provided the researcher to review any changes in performance when the intervention was introduced, contrasted with participants who were still completing their baseline phase. This is particularly helpful when analysing AB designs as they are vulnerable to history and maturation validity threats (Barlow, et al., 2009).

5.6 Research Questions

The data analysis methods described above were applied to the data gathered to explore the effect of Precision Teaching on aspects of motivation. The following table reviews the research questions this project set out to investigate prior to a full description of the data.

Table 5.4 Research questions and analysis methods

Research question	Research design	Measure	Analysis procedure
Does Precision Teaching have a positive effect on control attributions of male pupils towards literacy learning outcomes?	Series of four single-case experiments	Multidimensional Measure of Children's Perceptions of Control (MMCPC, Connell, 1985) - Internal control - Powerful others control - Unknown control	Visual analysis of within and between phase data Numerical analysis Inter-observer agreement
Does Precision Teaching have a positive effect on academic self-efficacy perception of literacy learning?	Pre and post intervention data.	MALS	Reliable change analysis of pre and post measurements.
How might PT	Post	Semi-structured	Thematic analysis

impact motivation towards literacy for these pupils?	intervention data	interview with individual pupils	using motivation theories to guide transcript analysis.

As part of a mixed methods research design, deductive and inductive data were gathered using quantitative and qualitative data. For the quantitative sub-questions 1 and 2, the following hypotheses were made:

Experimental hypothesis: The implementation of PT will increase motivation as observed in increased levels of internal attributions of control, and lower ratings of powerful others and unknown attributions of control over learning outcomes as shown in MMCPC ratings. This will also be identified through an increase in self-efficacy ratings.

Null hypothesis: There will be no change to locus of control attributions or self-efficacy ratings following introduction of PT.

5.7 Multiple baseline analysis

Multiple baselines of nine participants were analysed by three inter-rater judges for each element measured by the MMCPC (Connell, 1985). The baseline phases of these single-case designs varied from three to six weeks. All baselines contained three data points despite data being gathered over longer time periods for some pupils as outlined in Appendix 37. The researcher acknowledges that whilst three data points is acceptable for analysis of single-case designs, further data points would have strengthened conclusions about baseline stability. The limited number of data points creates some limits to the conclusions that can be drawn about the stability of the baseline phases. Examples of stable and unstable baseline patterns were provided to the inter-raters using examples from Barlow et al. (2009) (see Appendix 33). Inter-rater reliability was completed (see Appendix 36) to rate stability using the Fleiss Kappa statistic (Fleiss, 1971) (see Section 5.4.3). In the discussion below, a baseline is described as achieving stability if it was given ratings of “Agree” or “Strongly agree” by three inter-raters.

Internal

On examination of the baselines for nine pupils, six single-case designs met the criteria for baseline stability as judged by three inter-rater judgements (see Appendix 28). Internal ratings of control were at ceiling level within the baseline phase for five of these seven participants, with the remaining two participants producing ratings predominantly above the mid-point range of the scale. Inter-rater agreement was calculated as 0.669388 indicating moderate to substantial reliability of agreement between inter-rater judgements. Therefore analysis of the internal control changes for Pupils A, B and C in the following results analysis are strengthened by the stability observed for participants who had not yet received the intervention in this multiple baseline analysis.

Powerful Others

On examination of the baselines for nine pupils, five single-case designs met the criteria for stability as judged by three inter-rater judgements (see Appendix

28). There was a broad range of ratings provided by participants, with ceiling effects present in the baseline data of Pupil A and Pupil G, to floor ratings produced by Pupil B. Inter-rater agreement was calculated as 0.247212 indicating that fair agreement between inter-rater judgements. Tentative conclusions can therefore be made regarding the stability of participant responses within the 'powerful others control' factor of the MMCPC and any effect observed in the intervention data for Pupil A, B and C.

Unknown

On examination of the baselines for nine pupils, the baseline phase data for Pupil A, B and G met the criteria for stability as judged by three inter-rater judgements (see Appendix 28). The range in baseline values was extensive, from near ceiling effects in the data of Pupil G and A, to scores below the mid-point range on the scale for the remaining participants. Inter-rater agreement was calculated as 0.258824 indicating that judgements between raters were at a level above that expected by chance and produced fairly reliable judgements of baseline stability. Unknown control data was observed by inter-raters to produce six unstable baselines, and therefore stability across the data set for this element of control could not be confidently assumed. This results in highly tentative conclusions when analysing intervention effects for unknown control in the data of Pupils A, B and C.

5.8 A-B SCED data analysis

Results of the four single case studies are presented in the following section.

5.8.1 Fidelity to PT intervention

An observation of two PT sessions was undertaken for each pupil (A, B, C and D) by the researcher during the intervention phase (Appendix 13). Teaching Assistants completing the PT sessions using good teaching techniques which were motivating for pupils. During the initial observation, staff required some support to ensure treatment fidelity. These items were:

- Limiting the number of items being used in the teaching,
- Ensuring the words taught were the words used within the probe at the end of the teaching session,
- Ensuring the area where the session was taking place was quiet and free of distractions,
- Completing the chart with the pupil,
- Referring specifically to the aim rate and encouraging the pupil to make effort to beat this score in the next session,
- Teaching non-similar items in a session.

The researcher discussed these items with the staff members and reviewed the PT principles covered in the training staff had received. These elements were checked in a subsequent fidelity check on which occasion the elements discussed were present for Pupils A and C. For pupils B and D further advice was provided after the second check to support fidelity to the intervention.

5.9 Pupil A

5.9.1 Context

Pupil A attended the Year 5 class of mainstream primary L at the time of the research project, aged 9 years 8 months. He had been placed on the School Action register due to concerns regarding his limited literacy progress. Pupil A was described by staff as displaying some low-level disruptive behaviours in lessons such as making noise at inappropriate times during the lesson, talking to other pupils during individual work, and receiving regular negative behaviour points during lessons. He was also appearing to be increasingly disengaged, not completing individual work despite having the pre-requisite skills to do so and appearing to lack concentration during teaching times. These behaviours were apparent to staff particularly in literacy lessons. Pupil A's academic progress levels during Year 5 were in September 2012 Reading (2C) and Writing (1A), and in September 2013 Reading 2A+ and Writing 2C+. He had not received support from Local Authority support agencies prior to this project.

5.9.1.1 Delivery of intervention

Training was provided as described in Section 4.4.2. During the intervention, Teaching Assistants used high frequency words (HFW) as determined by the school (My First Years, 2004) which were already being practiced and focussed on during literacy sessions. They reviewed his HFW knowledge and taught for a maximum of 10 minutes, with the HFW being included in sessions before lower frequency words. Words were written on flash cards and the whole list presented to him within each session. During the intervention phase the teaching activities were adapted according to the PT guidance where pupil progress did not increase at an adequate rate (see Appendix 5). During the intervention phase, teaching was limited to short lists of words and presented using flash cards but also incorporated into games such as finding an identical pair, and timed activities such as 'fast reading' and finding the word in a passage of text.

Pupil A's progress during the PT intervention was recorded on a chart (see Appendix 29) in accordance with PT guidance. Pupil A's performance followed

a consistent pattern over subsequent blocks of words, with correct items increasing and incorrect items decreasing to the aim rate before a novel block of words were introduced. Staff experimented with changing the number of words being taught due to Pupil A's delay in reaching the correct performance aim rate. They also adjusted the games being used during the second and fifth block of items to support Pupil A's engagement. Staff reported that Pupil A regularly compared his performance scores competitively with Pupil B.

5.9.2 Does Precision Teaching have an effect on Pupil A's perception of control over learning?

Visual analysis was undertaken on the graph of Pupil A's ratings of MMCPC subscales of powerful others control, unknown control and internal control. The visual description and numerical analysis to elaborate on the graph elements are described separately for each control factor. Perceived powerful others control data can be viewed in Figures 5.1, 5.2, 5.3, 5.4, and 5.5, with numerical data presented for this control element in Table 5.5. Unknown perception of control data can be viewed in Figures 5.6, 5.7, 5.8, 5.9 and 5.10, whilst numerical data is presented in Table 5.6. Internal control data is presented in Figures 5.13, 5.14, 5.15, 5.16 and 5.17, with numerical data for this control element included in Table 5.7.

5.9.2.1 Pupil A perceived powerful others control

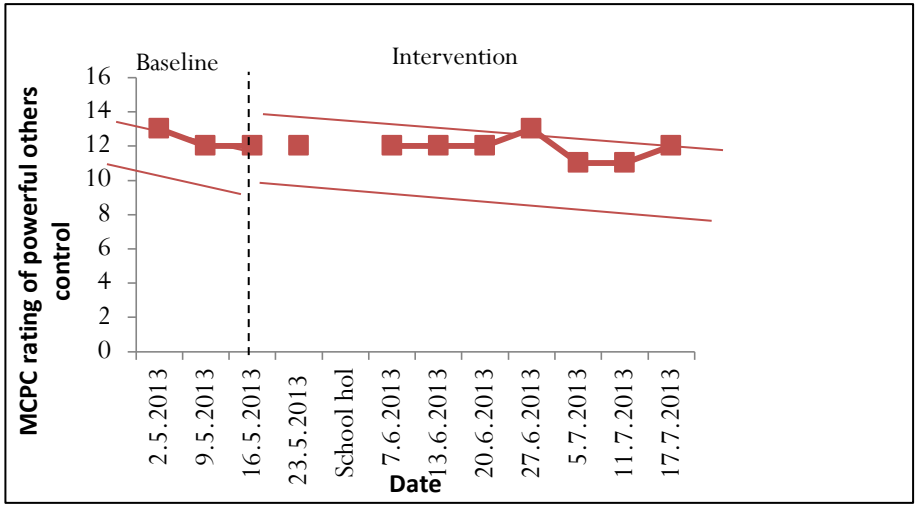

Figure 5.1 Graph to show variation in powerful others ratings of Pupil A.

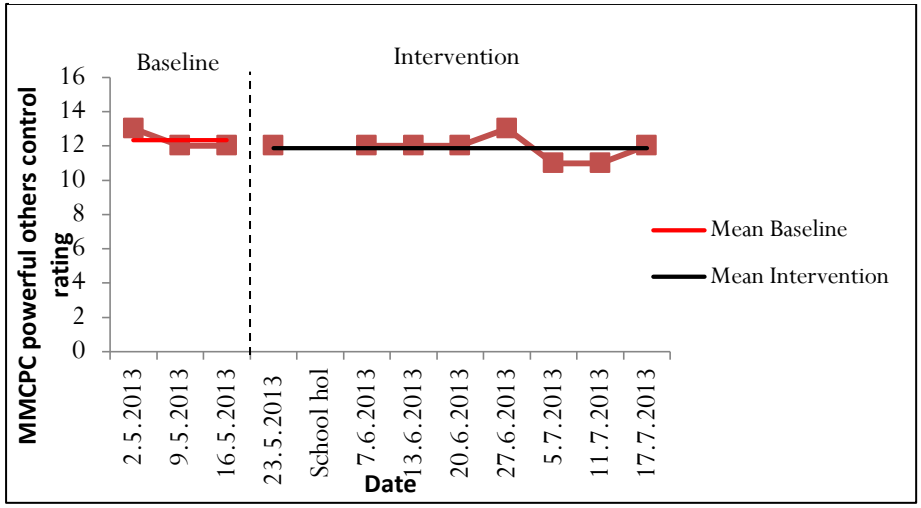

Figure 5.2 Graph to show level change in powerful other ratings of Pupil A.

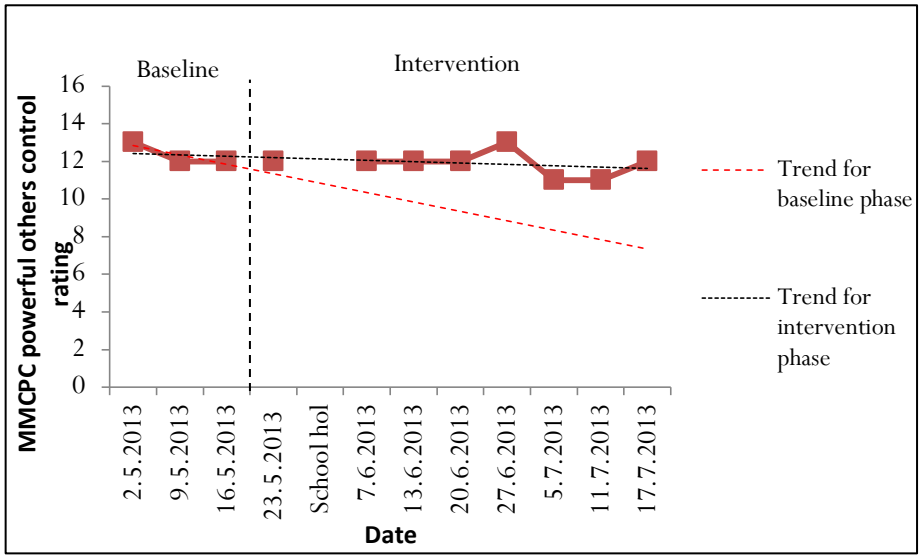

Figure 5.3 Graph to show trend in powerful others ratings of Pupil A.

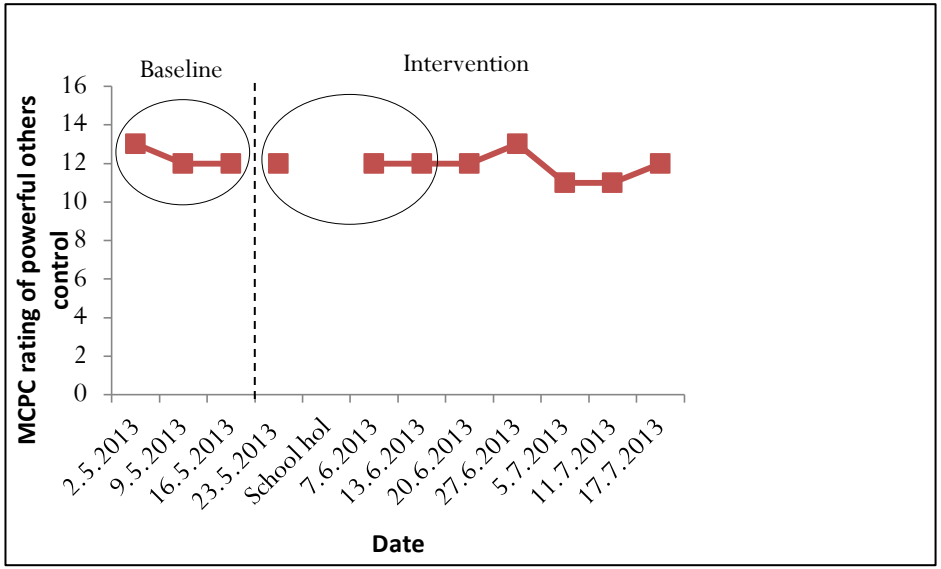

Figure 5.4 Graph to show immediacy of effect in powerful others ratings of Pupil A.

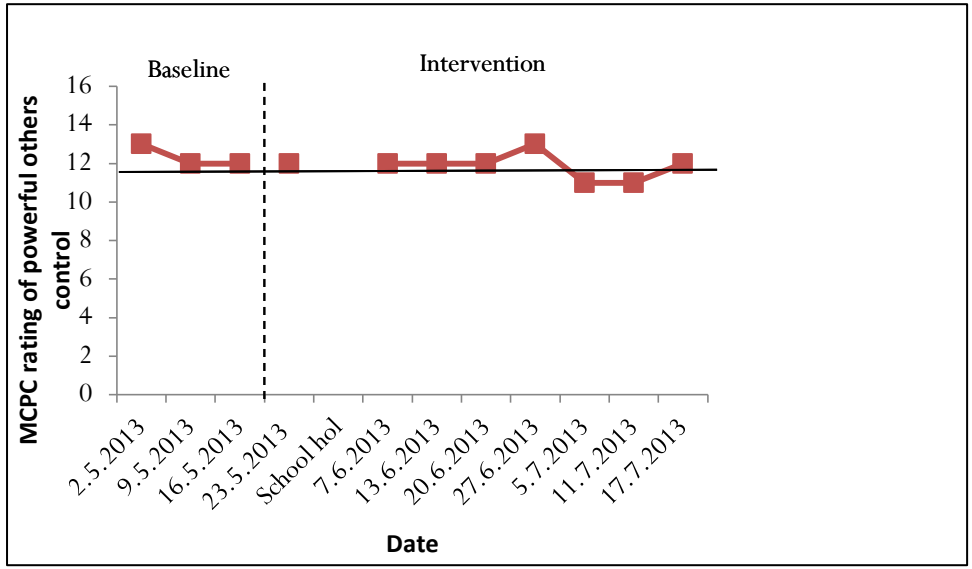

Figure 5.5 Graph to show overlap in powerful others ratings of Pupil A

Table 5.5 Visual and numerical analysis summary for Pupil A: powerful others control

Analysis factor	**Visual analysis description**	**Numerical measurement outcome**
Level	Within this graph (Figure 5.2), the average rating is very similar across the baseline and intervention phase. The plotted average line is slightly lower in the intervention phase. On eyeballing the data, there are no obvious outliers which would affect the representativeness of the mean calculation	Baseline mean rating: 12.333 Intervention mean rating: 11.875 Mean change: 11.875-12.333=-0.458 Mean shift:-0.037 (3.7% decrease)
Variability	Variation between the data points in the baseline and the intervention phase is small as shown in Figure 5.1. Through eyeballing the data, ratings also seem to be clustered relatively closely around the mean line.	Variation for Phase A: 0.333 Variation for Phase B: 0.410 Standard deviation for Phase A: 0.577 Standard deviation for Phase B: 0.640
Immediacy of effect	On review of the three data points in the baseline and first three data points (Figure 5.4) in the intervention phase, there is very limited difference between these values.	Last Phase A data value:12 First Phase B data value:12
Overlap	Only two data points were visually analysed to be	Baseline phase improvement rate: 0%

	independent of the other data points (Figure 5.5). This is calculated as an 81% overlap between baseline and intervention phase data points indicating a limited change between phase data.	Intervention phase improvement rate: 23% IRD = 23%
Trend	The predicted trend for the baseline phase indicates a decreasing slope gradient (Figure 5.3). The intervention phase data has level trend line, indicating minimal change during the intervention phase.	Baseline trend line equation: y = -0.5x+13.333 Intervention trend line equation: y = 0.0727x +12.484

5.9.2.1.1 Pupil A powerful others control inter-rater reliability

The baseline was rated as stable with an inter-rater agreement value (k) of 0.25. This indicates that overall agreement of rater judgements to agreement categories provides fair reliability. However the inter-raters gave neutral judgements that a change could be observed between phases, with these ratings providing a moderate level of reliability (k = 0.55). Inter-raters disagreed that a significant change occurred between the phases of data, with a fair reliability value corresponding with these judgements (k = 0.307692). Through inter-rater judgement of visual analysis of the data, the ratings for powerful others control over learning for Pupil A can therefore be analysed as stable within the baseline and did not vary markedly from this level during the intervention.

5.9.2.2 Pupil A perceived unknown control

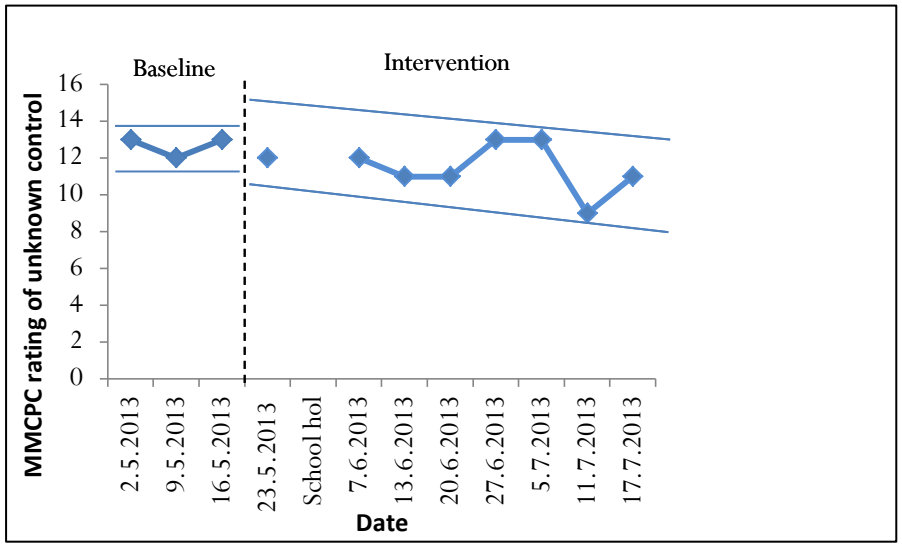

Figure 5.4 Graph to show variability in unknown control ratings of Pupil A

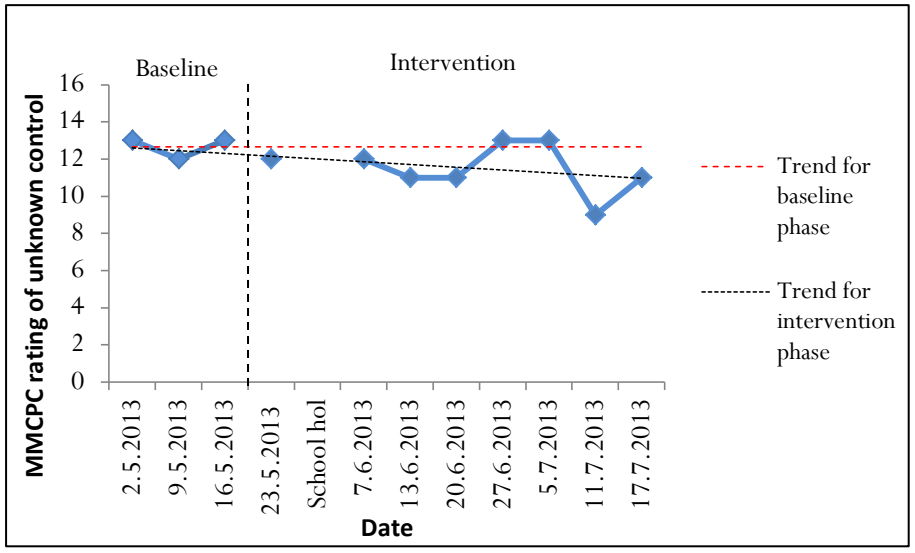

Figure 5.6 Graph to show trend in ratings of unknown control for Pupil A

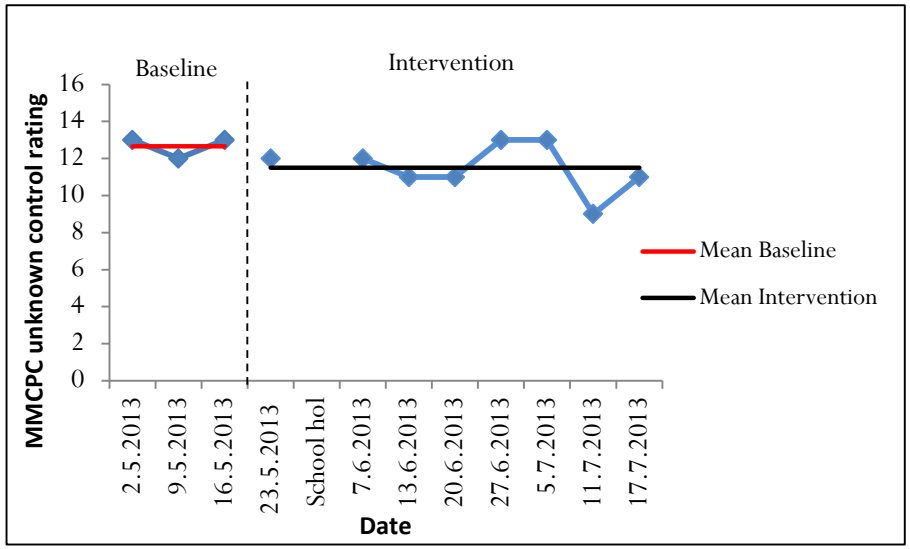

Figure 5.5 Graph to show level in unknown control ratings of Pupil A.

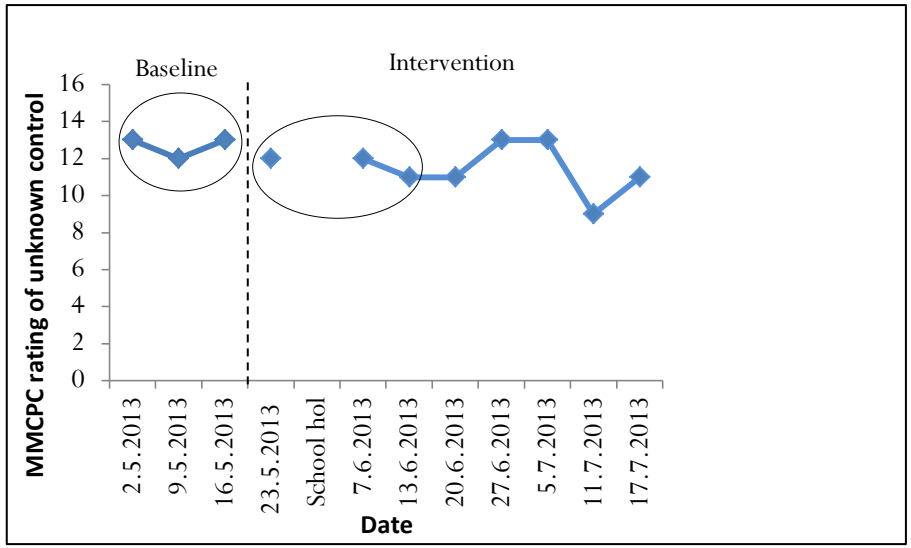

Figure 5.8 Graph to show immediacy of effect in unknown control ratings for Pupil A

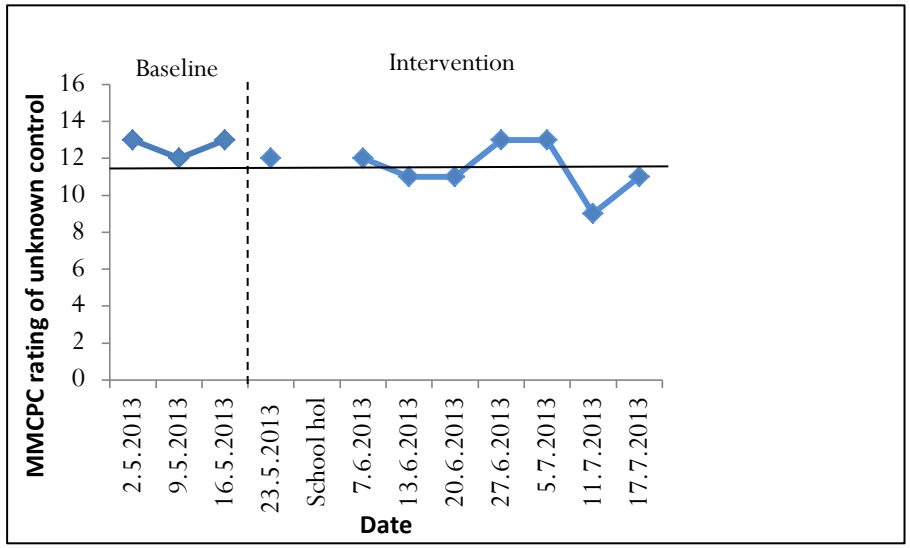

Figure 5.7 Graph to show overlap in unknown control ratings of Pupil A.

Table 5.6 Visual and numerical analysis summary for Pupil A: unknown control

Analysis factor	**Visual analysis description**	**Numerical measurement outcome**
Level	There is a limited change in the overall means between the baseline and intervention phases (Figure 5.2), although the mean rating within the intervention phase is slightly lower.	Baseline mean rating: 12.666 Intervention mean rating: 11.5 Mean change: 11.5-12.666=-1.166 Mean shift: 0.09 (9% decrease)
Variability	From eyeballing the data, there is a higher level of variance within the intervention phase than in the baseline phase (Figure 5.3). Data points are closely clustered around the mean in the baseline phase, but much less so in the intervention phase.	Variance for Phase A: 0.333 Variance for Phase B: 1.713 Standard deviation for Phase A: 0.577 Standard deviation for Phase B: 1.309
Immediacy of effect	The three data points within the baseline phase can be viewed to be slightly higher than the first three points in the intervention phase (Figure 5.4). However there is some overlap between these points.	Last Phase A data value:13 First Phase B data value:12
Overlap	Seven data points of a total of eleven overlap (63%) therefore indicating some	Baseline phase improvement rate: 0% Intervention phase improvement

	change between the baseline and intervention phase data (Figure 5.6)	rate:50% IRD = 50%
Trend	The linear trend line for the baseline phase is level and the predicted trend line continues at this level (Figure 5.5). The intervention phase trend line decreases on a slight downward gradient.	Baseline phase: y = 0x+12.667 Intervention phase: y = 0.1504x + 12.579

5.9.2.2.1 Pupil A unknown control inter-rater reliability

Inter-rater judgements strongly agreed that the baseline data points were stable, with a moderate to substantial reliability agreement value (k = 0.608696). Inter-rater judgements also agreed that there was a change between the baseline and intervention phases although the inter-rater reliability rating was slight (k = -0.2), and that this change was significant with a fair level of reliability to this agreement (k = 0.320755).

5.9.2.3 Pupil A perceived internal control

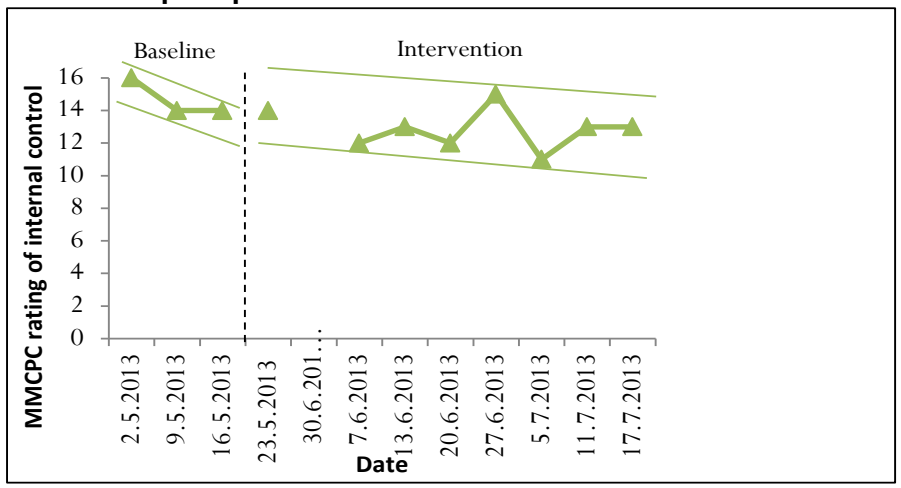

Figure 5.13 Graph to show variability in the internal control ratings of Pupil A.

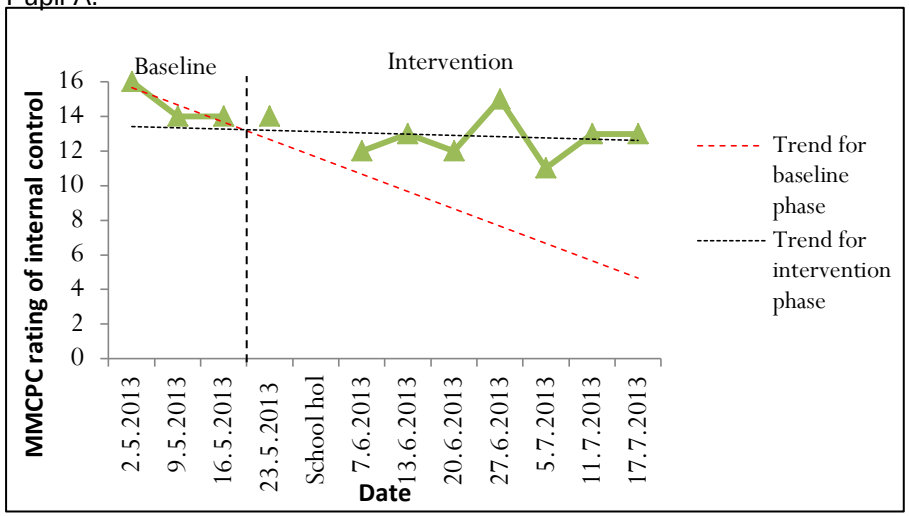

Figure 5.12 Graph to show trend in internal control ratings of Pupil A

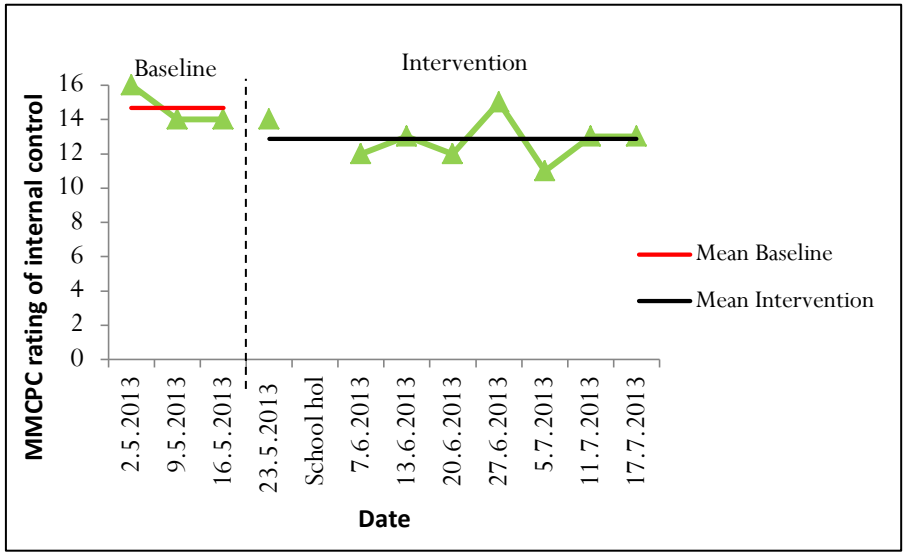

Figure 5.11 Graph to show level in the internal control ratings of Pupil A.

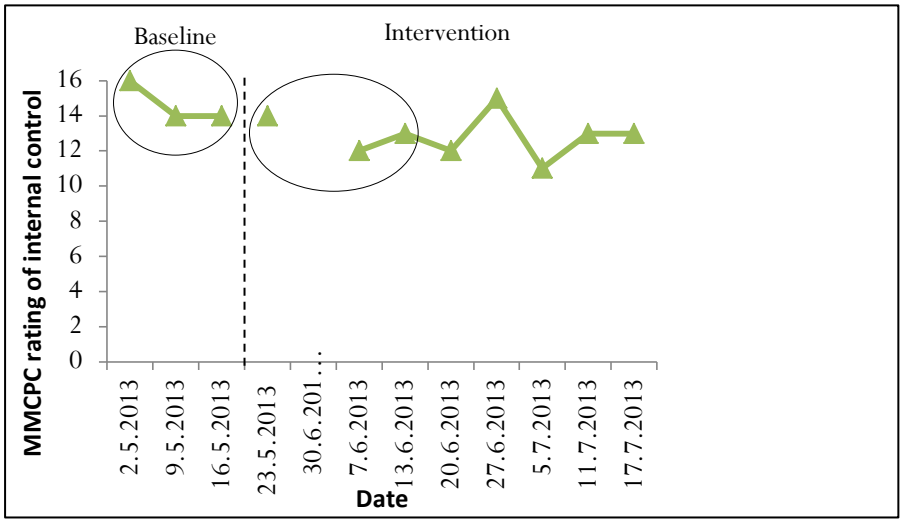

Figure 5.15 Graph to show immediacy of effect in internal control ratings for Pupil A

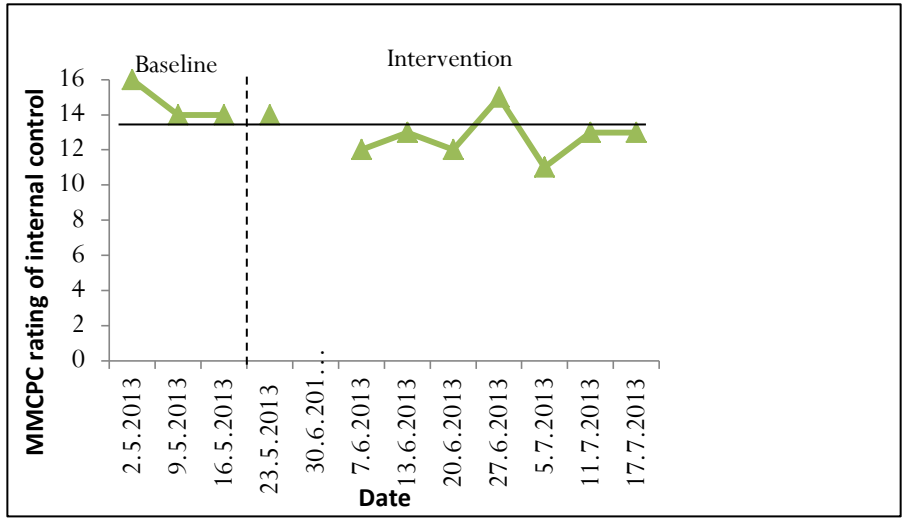

Figure 5.14 Graph to show overlap in the internal control ratings of Pupil A.

Table 5.7 Visual and numerical analysis summary for Pupil A: internal control

Analysis factor	**Visual analysis description**	**Numerical measurement outcome**
Level	From visual analysis of the average ratings as plotted on the graph (Figure 5.9), the ratings are slightly lower in the intervention phase than in the baseline phase.	Baseline mean rating: 14.667 Intervention mean rating: 12.875 Mean change: - 1.792 Mean shift: - 0.122 (12% decrease)
Variability	The variability in data points within the baseline and intervention phases is reviewed to be slightly increased in the intervention phase (Figure 5.10).	Variation for Phase A: 1.333 Variation for Phase B: 1.553 Standard deviation for Phase A: 1.154 Standard deviation for Phase B: 1.246
Immediacy of effect	On comparison of the three data points in the baseline and first three data points of the intervention phase (Figure 5.7), although there is overlap, the intervention phase data points are the same or lower than those in the baseline. This indicates a decrease in pupil ratings immediately as the intervention is put into place.	Last Phase A data value:14 First Phase B data value:14
Overlap	Five of the eleven data points are overlapping (45 %). Eyeballing this graph (Figure 5.11) indicates the intervention phase data	Baseline phase improvement rate: 33% Intervention phase improvement rate: 75% IRD= 42%

	display some decrease in comparison to the baseline data.	
Trend	The linear trend within the baseline phase appears to decrease very steeply with the intervention trend line at a level and stable slope (see Figure 5.8).	Baseline trend line: y = -0x + 16.6667 Intervention trend line: y = -0.0727x+13.484

5.9.2.3.1 Pupil A internal control inter-rater reliability

Inter rater judgements indicate that the stability of the baseline is not clear with an inter-rater agreement level calculated as providing fair reliability that judgements made above the agreement level were not achieved by chance (k = 0.3333). One inter-rater judge indicated that they agreed that the baseline was stable, with the remaining two judgements indicating neutral views. Inter-rater judgements indicate a fair level of reliability in their agreement about the change of the data between the baseline and intervention phases (k = 0.307692), with three judgements agreeing that a change could be observed. Two inter-raters gave neutral judgements as to the significance of this change, with one inter-rater agreeing the change between data phases was significant. These judgements indicate fair reliability, with a k value of 0.37931.

5.9.3 Summary of MMCPC ratings for Pupil A

Overall the MMCPC ratings produced by Pupil A suggests that Precision Teaching had no impact on this pupil's ratings of the effect of powerful others on his learning, with Pupil A's perception that powerful others have a high level of control over his learning sustained throughout the baseline and intervention phases. A decrease in the unknown control within the intervention phase could indicate that Precision Teaching had a positive impact on Pupil A's ability to locate control over his learning and locate reasons for learning outcomes. However, internal control also appeared to decrease slightly in the intervention

phase but remain within high ratings throughout the intervention phase, potentially indicating a ceiling effect. This decrease in internal control corresponds to a similar trend in unknown control, however the researcher is not able to confidently assert there is a relationship between these two factors. The implication of this for future research will be discussed in the next chapter. The researcher noted anecdotal feedback during the weekly data gathering and indicated that Pupil A was becoming familiar with the repeated measures procedure and did indicate a lack of enthusiasm to complete the measures on some occasions. The ratings provided by this pupil may therefore not be representative of Pupil A's true perspective.

5.9.4 Does Precision Teaching have a positive effect on academic self-perception for Pupil A?

Myself as a Learner Scale (Burden, 1999)

Pupil A's pre-baseline performance in this measure was 85, with a post-intervention score of 71 as shown in Figure 5.18. This equates to a decrease between these time points of -14. The RCI value is calculated -18.421. This value exceeds the significant difference statistic stated within the reliable change index literature (Speer, 1992), and therefore indicates a significant change between the pre and post-test scores given by Pupil A. However there is a decrease of 14 between Pupil A's first and second score. This could indicate the potential for Precision Teaching to have had a negative impact on Pupil A's perception of himself as a learner. However it should be noted that on the occasion of taking the second MALS measure, there were a number of possible confounding variables which could have impacted Pupil A's responses. Pupil A was extremely distracted during this session as he had been removed from a lesson he enjoyed. He therefore responded extremely quickly to the questionnaire items and the researcher was dubious as to how accurately these responses reflected the pupil's true feelings.

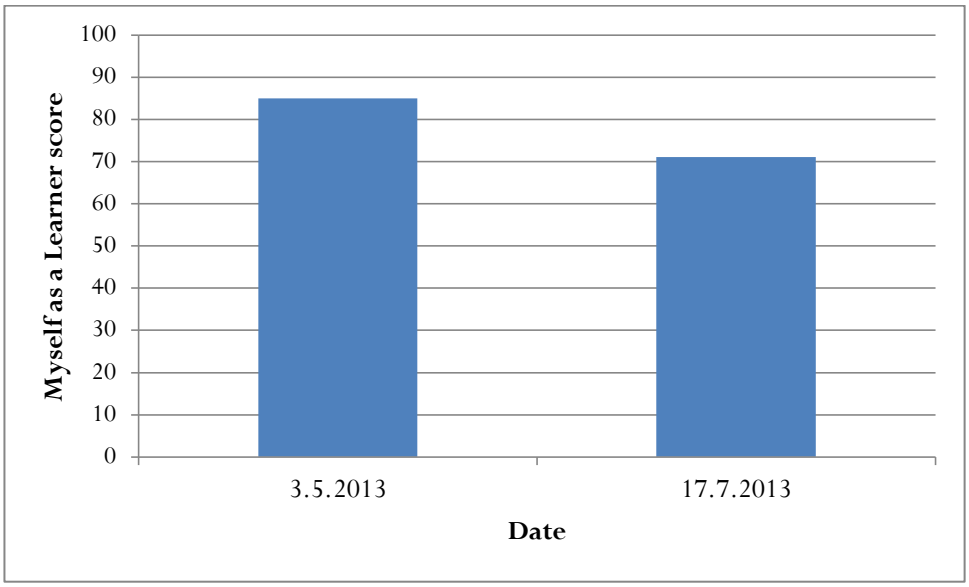

Figure 5.16 Graph to show change in MALS scores for Pupil A

5.9.5 How might Precision Teaching have impacted motivation towards literacy for Pupil A?

The full thematic analysis of this interview can be found in Appendix 21. Extracts of the data are stated below to illustrate Pupil A's perceptions regarding progress made within literacy and perceptions of what contributed to literacy progress during PT sessions. The theoretical code used to analyse this data is described in Section 5.4.4.

Attribution theory

Thematic analysis of the interview data for Pupil A appeared to show a number of internal attributions for learning changes including personal effort and ability. Pupil A reported that he noticed changes in his literacy skills during the Precision Teaching sessions. When asked for his views on what caused these changes, he reported a number of internal attributions. He attributed some internal ownership and responsibility for his learning, indicating on a number of occasions attributions of his successes being influenced by his effort ("Like practiced them [HFW] and that…practiced them") and ability ("It [charting] was easy, cos all you needed to do was count them"). Pupil A also described a number of external factors which he felt contributed to learning changes, attributing lower scores in PT sessions with lack of sleep ("I must not have had a good sleep"), and attributing the environment as a key factor impacting on his progress ("**Interviewer:** Right, cos being quieter helps you concentrate? **A:** Yeah…I didn't get put off").

Specifically Pupil A appeared to indicate that teachers had a high level of control over how much he learned (**Interviewer:** "Ok, so they didn't do anything to make the changes happen? Who did then?" **A:** "The teachers…"). He specifically noted staff responses as important to his progress ("Like helping me read hard words and the ones I were stuck on and that…", "They don't really shout or like…they just tell you…give you three warnings if you've been bad and give you a chance to like stop being bad.")

Pupil A indicated unknown attributions for learning changes on a number of occasions. Pupil A reported increasing instability in his learning progress ("I'm getting more…like at first I'd only get to here *(pointed to half way down the timed probe sheet)* and I'd get about two wrong, and then I like start getting here and then to here (*pointing to further down the timed test)*", indicating that he acknowledged changes in his literacy skills during his Precision Teaching sessions, and that his learning was changeable rather than fixed. When linked with Pupil A's responses on elements of control he felt he had over his learning, Pupil A emphasised the importance of staff to his learning progress regularly throughout the interview. Input from staff is not controlled by Pupil A and is an external force, therefore his acknowledgement of this input as a key element to his progress may indicate a limit to his feelings of internal locus of control over his learning progress. Pupil A also attributed changes in his learning to the Precision Teaching programme being in place ("…it [Precision Teaching sessions] like made it easier to read my books and all that...in class"), specifically the learning of higher frequency words ("this *(pointed to activities on the table)* helped me with my reading, like reading the words and that, like that comes up and they come up a lot in my books and that…so it helped me.." These statements indicated a perception that this intervention as an external resource had supported his learning.

The following data was located within a locus, stability and controllability attribution matrix as proposed by Weiner (1972). This data is presented here as these attributions were repeated on a number of occasions during Pupil A's interview.

Table 5.8 Internal attributions of learning progress during Precision Teaching sessions

	controllable	**uncontrollable**
stable	…and then I was getting them all right! (longer term change)	/
unstable	like practiced them [HFW] and that…practiced them	/

	(temporary effort)	

Table 5.9 External attributions of learning progress during Precision Teaching sessions

	controllable	**uncontrollable**
stable	/	They [teaching staff] don't really shout…(predictable external factor)
unstable	I must not have had a good sleep…(temporary fatigue)	/

Social learning theory

Pupil A highlighted that he was identifying the words he learned to read in the Precision Teaching sessions within his wider literacy activities ("…it [Precision Teaching sessions] like made it easier to read my books and all that...in class"). This indicates that Pupil A had learned skills which he was generalising to broader contexts, and recognising this application ("it like made it easier to read my books and all that...in class"). This indicates that he may have generalised his expectancy to be able to read these words successfully in wider contexts than only the Precision Teaching sessions, with a corresponding positive effect on his locus of perceived control over literacy learning ("I'm getting faster and I'm getting more right").

Pupil A identified that Precision Teaching supported his awareness of progress through the timed test (probe) results and recording this on the Precision Teaching chart. Pupil A was receiving feedback from the Precision Teaching methods ("**Interviewer:** you knew you were getting faster? **A:** Yeah"), which provided regular reinforcement of his learning progress ("…and then I was getting them all right!").

Achievement theory

Pupil A indicated feelings of positive affect following achievement of higher scores within Precision Teaching (**Inteviewer: "**What did the Precision Teaching sessions make you feel about what you were learning?" **A:** "It made me feel happy cos like when I'm older I can learn"). Pupil A stated that literacy skills were important because of their influence on future learning. Pupil A also reported that he felt literacy skills were important to learn for testing in school ("And then if I need to do a test thing or summat in college, like I'll know my reading and all that").

This indicates an external motivating factor, however it also may indicate an achievement motivation for Pupil A; that he is motivated to learn a skill for the purpose of achievement. However Pupil A does highlight the limits to his internal motivation to complete literacy tasks ("**A:** I'll do it…yeah I'll do it if I have to but..." **Interviewer:** "But…" **A:** "But I don't really like it") and therefore the internal achievement motive may conflict with his internal motivation and enjoyment of literacy activities. This highlights a tension between Pupil A's understanding of socially expected goals (doing tests) and his limited internal value of learning literacy for tests. It is unclear from this interview how external forces such as staff or family member values regarding the importance of exams may have impacted on Pupil A's response. Pupil A highlighted that learning HFW was very positive for him, he felt this was helpful in his wider reading and therefore had higher utility. The utility he identified of learning HFW as they "come up a lot in my books" highlights the potential link for Pupil A between his perceived utility of the skill he is learning and his motivation to apply his attention to literacy activities.

5.10 Pupil B

5.10.1 Context

Pupil B attended the Year 5 class of L Primary School at the time of the research project, aged 10 years 3 months. Pupil A was on the School Action Plus register due to low levels of progress. He had received some support from LA services to support his numeracy and literacy progress. Pupil B did not display any challenging behaviour but was becoming increasingly disengaged; not completing independent work in lessons, copying other students instead of working out answers independently despite mostly having the pre-requisite skills to do the task, and requiring staff prompts to complete tasks rather than initiating engagement. Staff described Pupil B to be a quiet pupil who typically did not ask for help within class, preferring to get on with a task himself despite requiring additional adult support. Staff perceived this to be as a result of peer comparison and Pupil B's desire not to be highlighted as an under-achiever. Multi-agency support was not occurring at the time of this project. Pupil B's academic progress during Year 5 was recorded in the school national curriculum attainment levels as Reading 1B+ Writing 1A+ in September 2012, and Reading 2C and Writing 2C+ in September 2013.

5.10.1.1 Delivery of intervention

The Precision Teaching (PT) training was delivered as described in Section 4.4.2. Baseline teaching sessions were used to teach Pupil B high frequency words (HFW) as determined by the school word lists (My First Years, 2004) which were being used during literacy sessions. TAs completed daily individualised sessions focussed on unknown words for a maximum of 10 minutes. Words were written on flash cards and the whole list presented to Pupil B during each session. During the intervention phase the teaching activities were differentiated according to the PT guidance. The words introduced in each session as guided by their frequency in literature, with the higher frequency words being included before lower frequency words. During the intervention phase, this list was limited to the words being learnt in the current phase and presented using flash cards but also incorporated into games

in response to analysis of Pupil B's engagement with the sessions guided by PT information and training.

Pupil B's progress during the PT intervention was recorded on a chart (see Appendix 30). During the initial and second block of words, Pupil B's performance demonstrated a high number of incorrect responses, and a decreasing trend in the number of correct responses. During the second block of items, staff reported that Pupil B experienced difficulty with this block of words and decreasing confidence. Therefore the words in this block were distributed over future blocks of items, and new engaging games introduced to promote re-engagement for Pupil B in accordance with PT guidance. Pupil B's performance then followed a consistent pattern over subsequent blocks of words, with correct items increasing and incorrect items decreasing to the aim rate before a novel block of words were introduced. Staff maintained four words within each block, theorising that above this number appeared to be more too challenging for Pupil B. Staff reported that Pupil B requested his probe assessment score after each session, and was aware of changes in his progress. Staff also reported that Pupil B consistently discussed competing to get a better score, and asked questions regularly about how his score compared with other pupils.

5.10.2 Does Precision Teaching have an effect on Pupil B's perception of control over learning?

Visual analysis was undertaken on the graph of Pupil B's perception of powerful others control, unknown control and internal control over his learning. The visual analysis description and numerical analysis to elaborate on the graph elements are described separately for each control factor. Perceived unknown control data can be viewed in Figures 5.19, 5.20, 5.21, 5.22 and 5.23, with numerical data presented for this control element in Table 5.10. Perception of powerful others control data can be viewed in Figures 5.24, 5.25, 5.26, 5.27, and 5.28, whilst numerical data is presented in Table 5.11. Internal control data is presented in Figures 5.29, 5.30, 5.31, 5.32 and 5.33, with numerical data for this control element included in Table 5.12.

5.10.2.1 Pupil B perceived unknown control

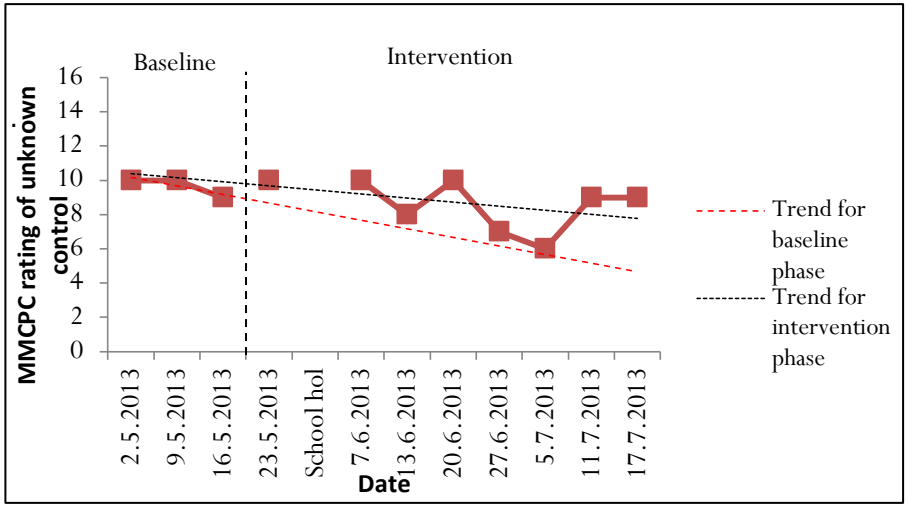

Figure 5.17 Graph to show trend in unknown control ratings for Pupil B

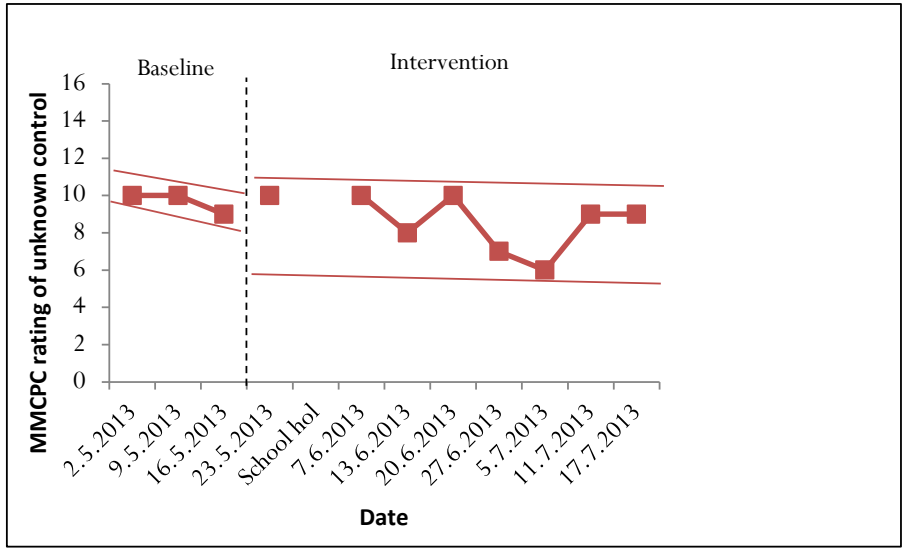

Figure 5.19 Graph to show variance in unknown control ratings for Pupil B

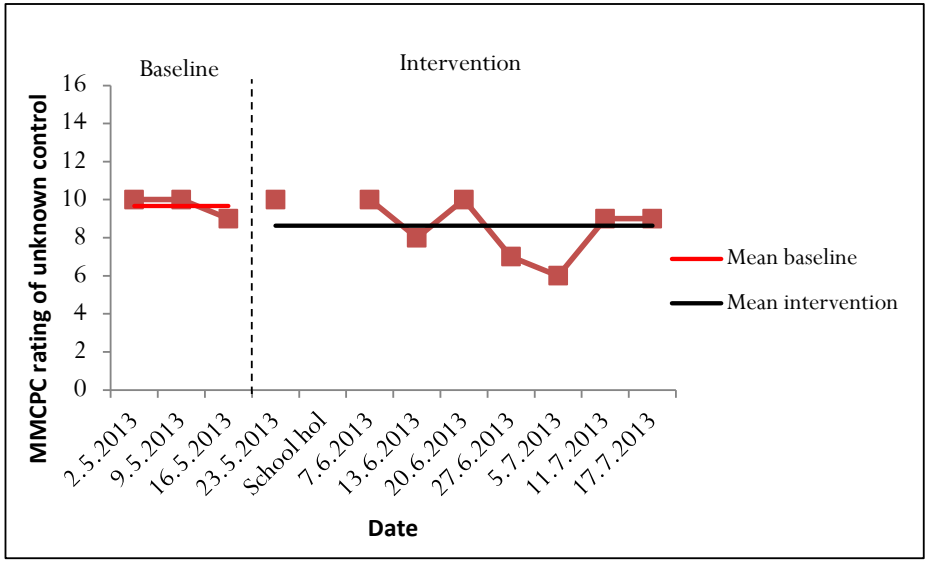

Figure 5.18 Graph to show level in the unknown control ratings of Pupil B.

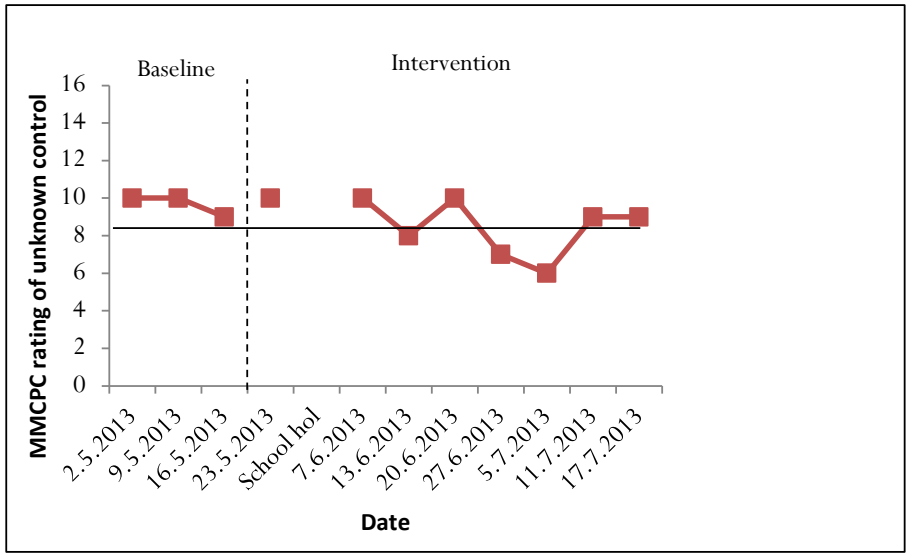

Figure 5.20 Graph to show overlap of unknown control ratings for Pupil B

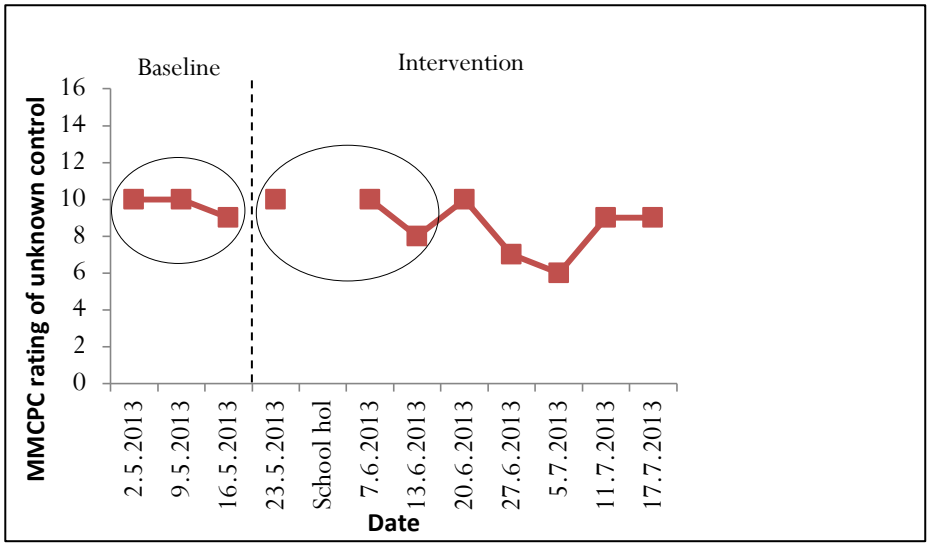

Figure 5.21 Graph to show immediacy of effect in unknown control ratings for Pupil B

Table 5.10 Visual and numerical analysis summary for Pupil B: unknown control

Analysis factor	**Visual analysis description**	**Numerical measurement outcome**
Level	Through eyeballing the data, there appears to be a small decrease in the average unknown control ratings in the intervention phase as compared with those of the baseline phase.	Baseline mean rating: 9.666 Intervention mean rating: 8.625 Mean change: - 1.041 Mean shift: -0.107
Variability	There is a much higher level of spread around the mean in the intervention phase than in the baseline phase as data points are visually more clustered around the mean line in the baseline phase.	Standard deviation for Phase A: 0.577 Standard deviation for Phase B: 1.505 Variation for Phase A: 0.333 Variation for Phase B: 2.267
Immediacy of effect	From visual analysis the three baseline points and the first three data points in the intervention phase do not present as largely different, although the final data point begins to indicate a further decreasing trend as the intervention phase continues.	Last Phase A data value:9 First Phase B data value:10
Overlap	Eight of the eleven data points overlap (72%), which indicates a limited amount of	Baseline phase improvement rate: 0% Intervention phase improvement

	independent data points. All baseline phase data points overlap with those in the intervention phase.	rate:37.5% IRD = 37.5%
Trend	Both trend lines are decreasing in gradient. The trend line appears to show a slightly decreasing slope within the intervention phase. However the projected trend from the baseline phase indicates an increasingly steep decline as compared to the intervention phase.	Baseline trend line: y = -0.5x+10.667 Intervention trend line: y = -0.2381+10.619

5.10.2.1.1 Pupil B perceived unknown control inter-rater reliability

Inter-rater agreement indicated that the baseline was stable with moderate to substantial reliability of these judgements (k = 0.608696), indicating a good level of control with which to compare the intervention phase data. Inter-raters agreed that there had been a change between the baseline and intervention phase data with a fair level of agreement (k = -0.24138). The significance of this change was agreed by one judge with neutral judgements from the remaining two inter-raters. These judgements were calculated to have a slight reliability (k = 0.068966).

5.10.2.2 Pupil B perceived powerful others control

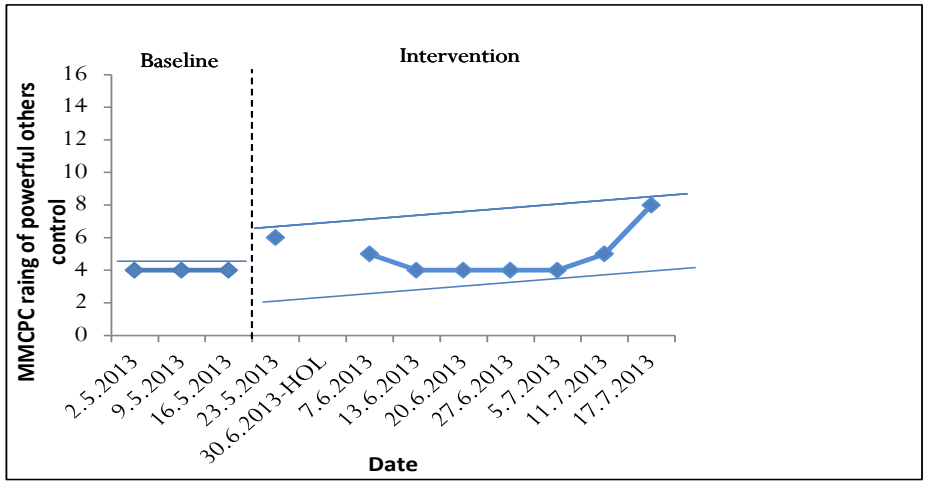

Figure 5.23 Graph to show variance in powerful others control ratings for Pupil B

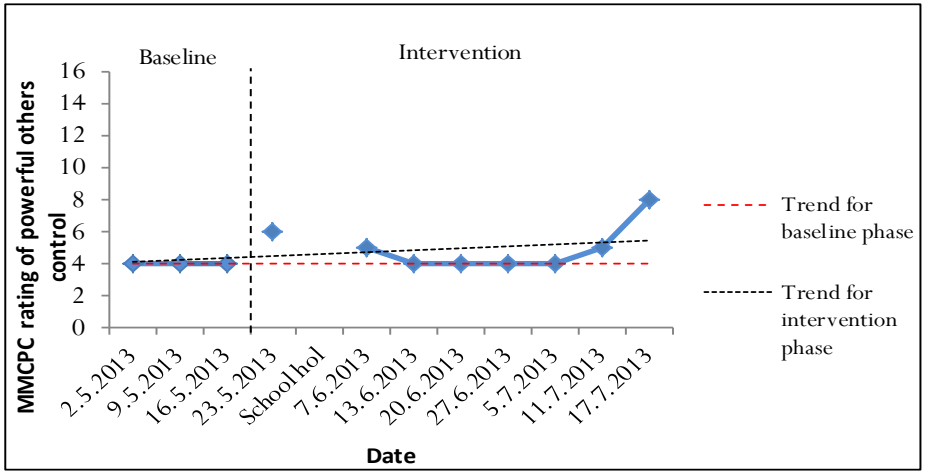

Figure 5.22 Graph to show trend in ratings of powerful others control for Pupil B.

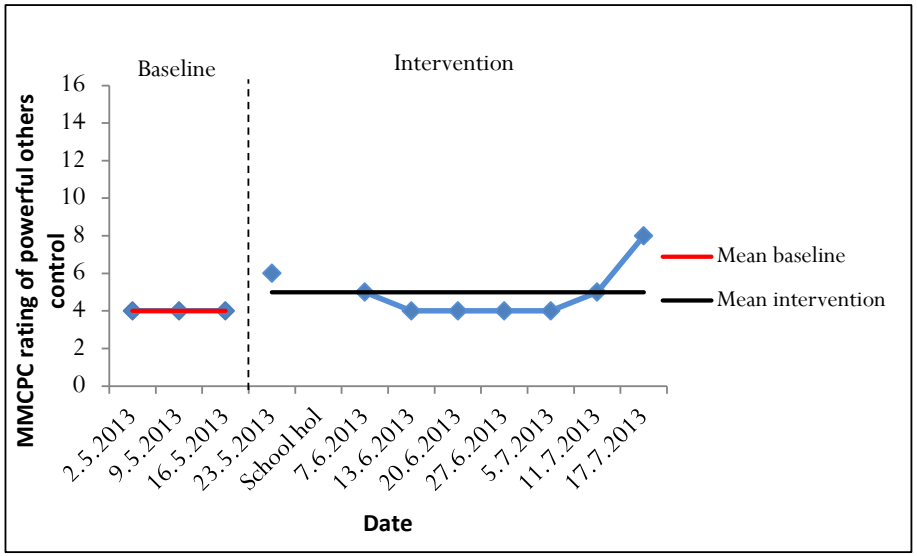

Figure 5.24 Graph to show level of ratings of powerful others control for Pupil B.

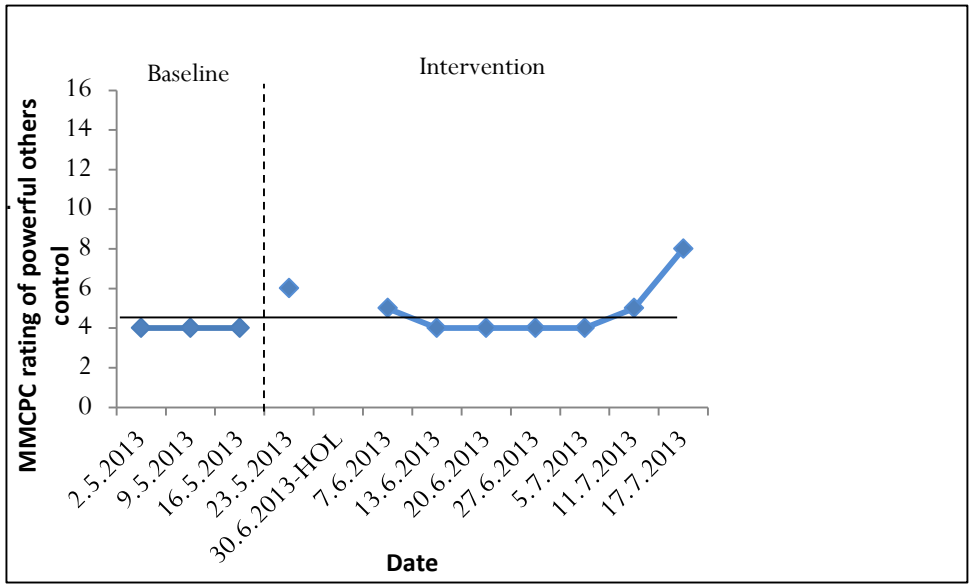

Figure 5.25 Graph to show overlap of powerful others control for Pupil B

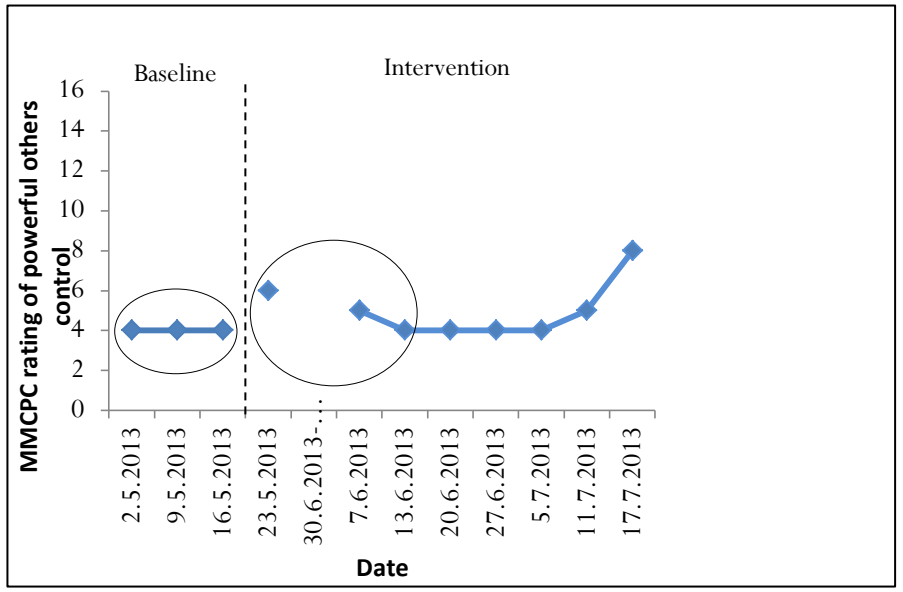

Figure 5.26 Graph to show immediacy of effect in ratings of powerful others control for Pupil B.

Table 5.11 Visual and numerical analysis summary for Pupil B: powerful others control

Analysis factor	**Visual analysis description**	**Numerical measurement outcome**
Level	Through eyeballing the data, the average rating within the baseline phase is slightly lower than the intervention phase.	Baseline mean rating: 4 Intervention mean rating: 5 Mean change: 1 Mean shift: +0.25
Variability	There is a wider spread of data points in the intervention phase than in the baseline phase.	Standard deviation for Phase A: 0 Standard deviation for Phase B: 1.414 Variation for Phase A: 0 Variation for Phase B: 2
Immediacy of effect	Although the first data point in the intervention phases differs by +2 from the last point in the baseline phase, comparison of the three baseline points with the first three intervention points indicates a limited difference between these ratings.	Last Phase A data value:4 First Phase B data value:6
Overlap	Seven of the eleven data points overlapped between the baseline and intervention phases (63%)	Baseline phase improvement rate: 0% Intervention phase improvement rate:50% IRD=50%
Trend	The trend line of the baseline phase is completely stable in its predicted trend. The	Baseline phase trend line: y = 4 Intervention phase trend line: y = 0.1203x+3.9925

	intervention phase trend line displays a slight increase in gradient.	

5.10.2.2.1 Pupil B powerful others control inter-rater reliability

For Pupil B baseline stability within powerful others control was agreed by all raters with a fair level of agreement between raters (k = 0.25). Inter-rater judgements unanimously agreed that a change had occurred between data in the baseline and intervention phase, with a moderate reliability value for this agreement (k = 0.55). However inter-raters varied in their judgement of the presence of significant change between the baseline and intervention phase, with two raters indicating neutral decisions, and one rater indicating agreement that a significant change was present. The reliability of this inter-rater agreement was indicated to be fair (k = 0.307692).

5.10.2.3 Pupil B perceived internal control

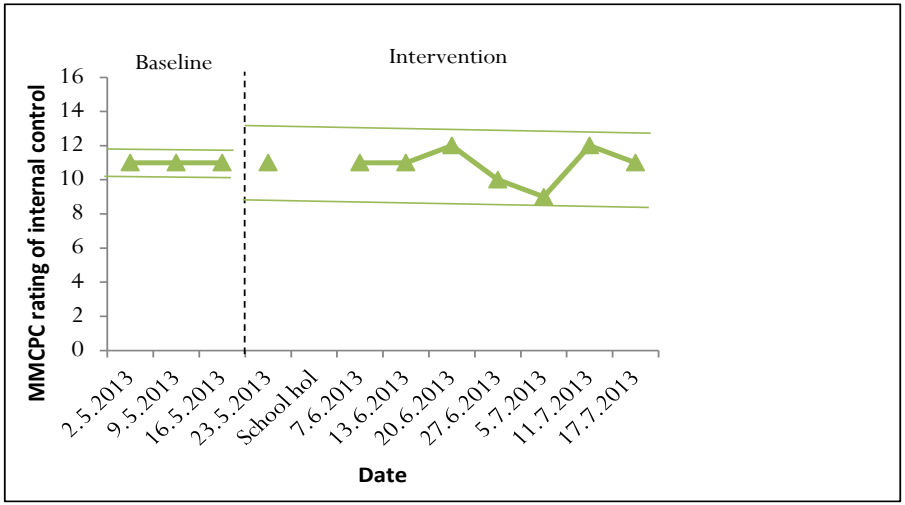

Figure 5.29 Graph to show variability in the ratings of internal control for Pupil B.

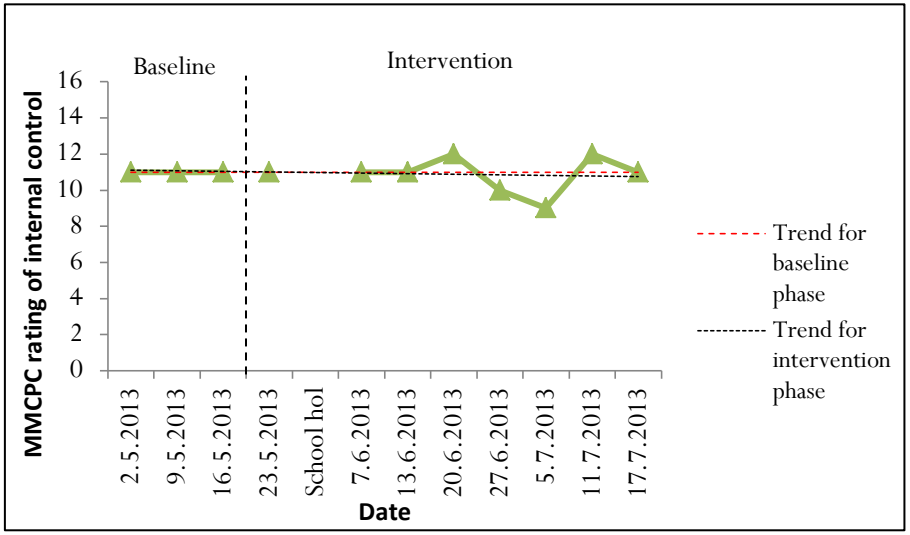

Figure 5.28 Graph to show trend in ratings of internal control for Pupil B

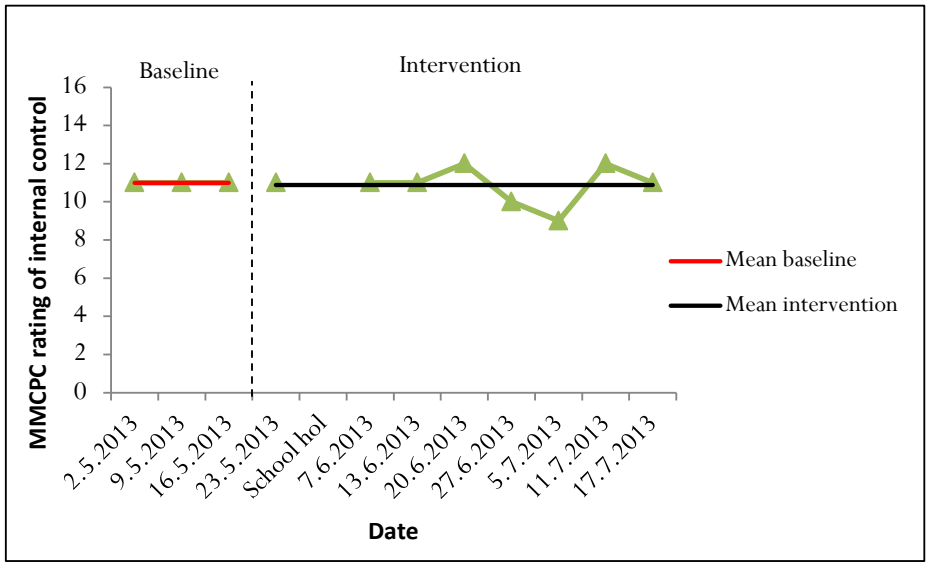

Figure 5.27 Graph to show level of the ratings of internal control for Pupil B.

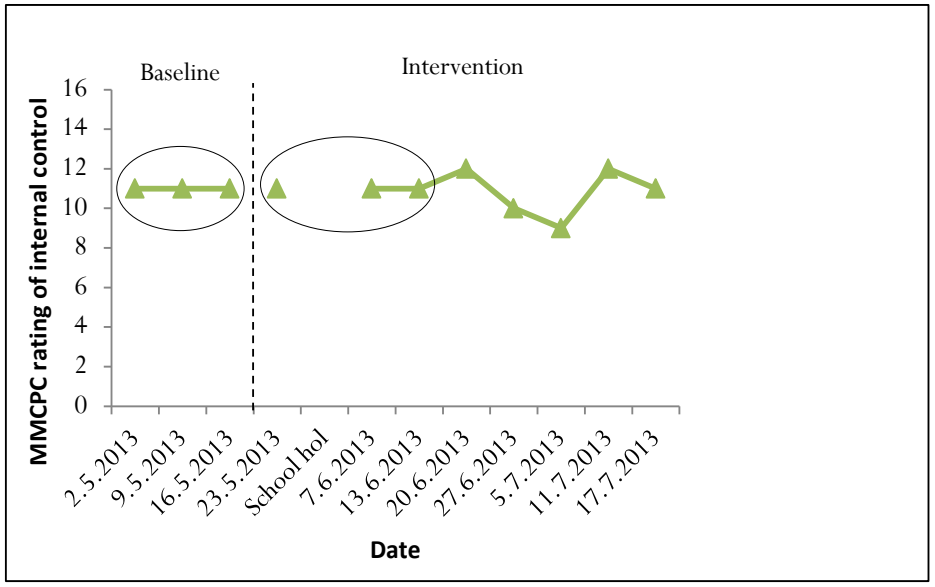

Figure 5.30 Graph to show immediacy of effect for internal control ratings for Pupil B

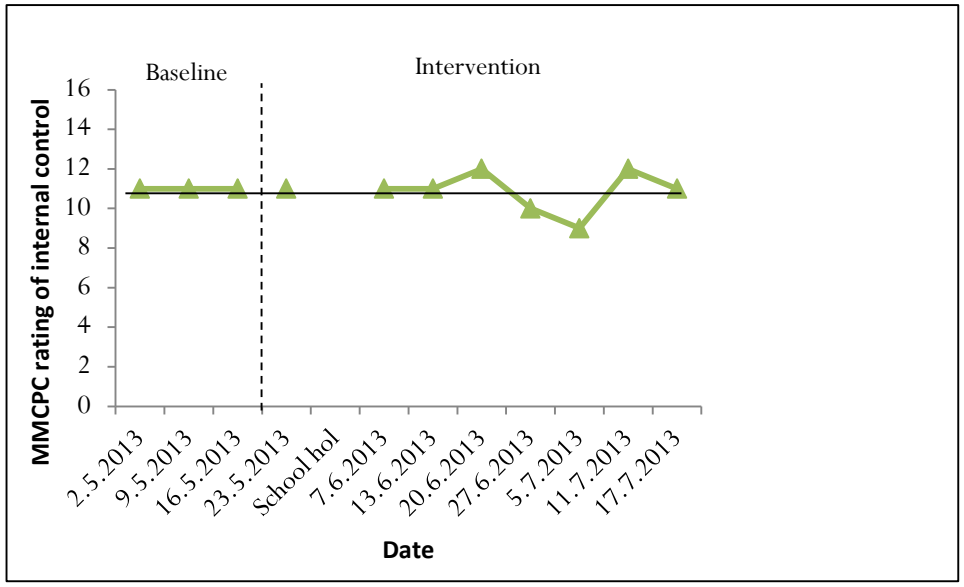

Figure 5.31 Graph to show overlap in the ratings of internal control for Pupil B.

Table 5.12 Visual and numerical analysis summary for Pupil B: internal control

Analysis factor	**Visual analysis description**	**Numerical measurement outcome**
Level	High mean level to begin with, maximum score being 16. Slight decrease in mean during intervention phase but not significant shift.	Baseline mean rating: 11 Intervention mean rating: 10.875 Mean change: - 0.125 Mean shift: -0.011
Variability	The data in the baseline phase displays no variance. There is also very limited variance in the intervention phase data although this is visually larger than within the baseline data points.	Standard deviation for Phase A: 0 Standard deviation for Phase B: 0.991 Variation for Phase A: 0 Variation for Phase B: 0.982
Immediacy of effect	Visual comparison of the three baseline data points and the first three data points in the intervention phase reveals no variation.	Last Phase A data value:11 First Phase B data value:11
Overlap	A high level of overlap is present in this data set (81%) with only two independent data points in the intervention phase.	Baseline phase improvement rate: 0% Intervention phase improvement rate: 25% IRD= 25%
Trend	The trend lines for each phase are very similar to each other. The baseline phase trend line is at a level gradient of 11 due to the stability of the baseline data points. The intervention phase trend line has a	Baseline phase trend line: y =11 Intervention phase trend line: y = 0.0326x+11.148

	slightly decreased gradient, however this decrease is small.	

5.10.2.3.1 Pupil B internal control inter-rater reliability

Within the baseline phase of ratings of internal control, inter-rater judgements all strongly agreed that the baseline data were stable with a fair reliability of this agreement between inter-raters (k = 0.3333). Two inter-raters reported neutral statements, with one in agreement regarding the presence of change between the baseline and intervention phase data. The reliability value for this inter-rater agreement was (k = 0.307692). Two inter rater judgements disagreed that a significant change was present between the baseline and intervention data, with one judge remaining neutral. A fair reliability value was calculated for these judgements made by inter-raters (k = 0.37931).

5.10.2.4 Summary of MMCPC ratings for Pupil B

From visual and numerical analysis, the mean data appears to indicate a slight decrease in Pupil B's perception of unknown control over his literacy learning from what was a high rating of unknown control during the baseline phase. However this decrease is indicated to be small, with high overlap between phases. Pupil B's unknown control rating decreased during the fourth and fifth week of the intervention phase, before increasing to previously held levels during the last two weeks of the intervention phase. It is not clear what led to this increase in unknown control ratings.

Within Pupil B's ratings of his perception of powerful others control through the MMCPC measure, there is an increase in Pupil B's ratings at the beginning and end of the intervention phase with stable ratings between these periods. The variation in the ratings in the intervention phase is larger than that of the baseline phase with these outliers likely to have affected the mean which is similar to the baseline phase average. The consistency of the intervention as identified by the researcher through fidelity checks (see Section 5.8.1.1), and the stable baseline identified by inter-rater judgement (see Section 5.8.2.2.1),

indicates that there may have been some impact of PT on powerful others control ratings for Pupil B.

There is a slight decrease in Pupil B's internal control ratings within the intervention phase, followed by an increased trend in the final weeks of the intervention. Pupil B began the baseline phase reporting ratings of 11 for internal control. Although a small increase in variance was present within the intervention phase, ratings between 8 and 12 were reported by Pupil B and the average rating remains similar to the intervention phase. Pupil B's perceptions of elements of internal control over learning therefore appear to indicate that the introduction of PT did not have a significant impact on his feelings of internal control.

5.10.3 Does Precision Teaching have a positive effect on academic self-perception for Pupil B?

Myself as a Learner Scale (Burden, 1999)

Pupil B's pre-baseline performance in this measure was 51, with a post-intervention score of 68 as shown in Figure 5.34. This equates to an increase between these time points of 17. The RCI value is calculated as 22.368. The RCI value of 22.368 calculated for the change between pre and post MALS values exceeds the significant difference statistic stated within the reliable change index literature (Speer, 1992), and therefore indicates a significant change between the pre and post-test scores given by Pupil B. This changes his performance in the MALS measure from a below average self-efficacy score, to within the average range of self-efficacy scores that could be expected.

Staff views were gained following the intervention phase. Staff reported that Pupil B had improved in his reading and evidenced using words learnt within the PT teaching sessions within wider reading, specifically his fluency within paired or group reading. Staff described that Pupil B showed a level of pride in his increased literacy skills during lessons, and recognised activities he was able to complete with higher levels of fluency due to his learning within the PT sessions. Staff reported that although Pupil B initiated completing the PT sessions and appeared motivated to take part in these, he did not show noticeable changes in his motivation to complete literacy activities within the wider mainstream curriculum.

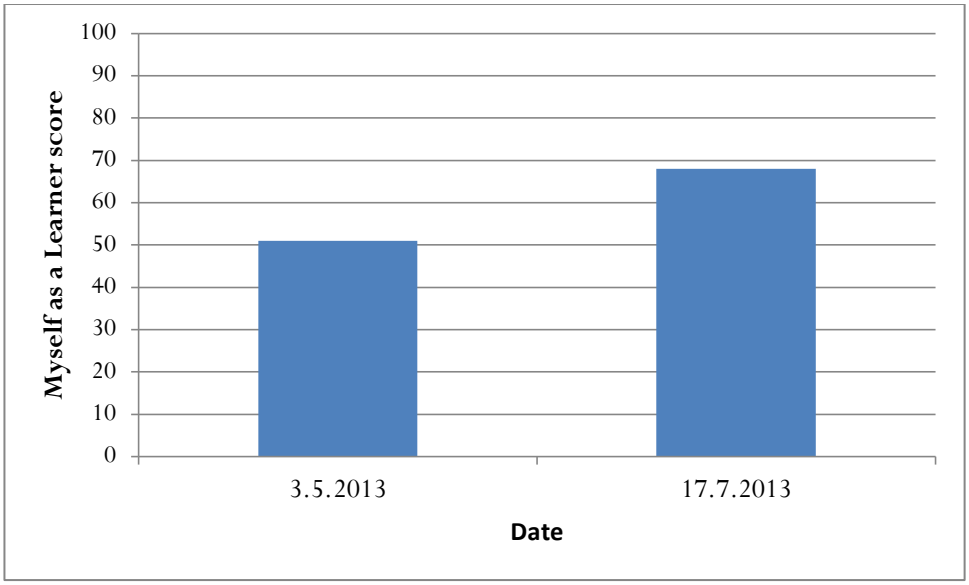

Figure 5.32 Graph to show changes in MALS score for Pupil B

5.10.4 How might Precision Teaching have impacted motivation towards literacy for Pupil B?

The full thematic analysis of this interview can be found in Appendix 22. Extracts of the data are stated below to illustrate Pupil B's attributions regarding progress made within literacy and perceptions of what contributed to literacy progress during PT sessions. The theoretical code produced to analyse this data is described in Section 5.4.4.

Attribution theory

Internal attributions indicated that Pupil B took ownership of his learning, with statements such as "I were getting more things right" and "I were reading quicker and I was reading more words". In addition Pupil B identified the need for personal effort as a pre-cursor for learning change ("words that I got stuck on, and then like keep learning them and learning them until then I could do em!"), which is incorporated within an internal locus of control. Pupil B highlighted external factors he perceived had impacted learning changes including staff support (**Interviewer: "**Ok did your teachers do anything to make those changes happen or to help those changes to happen in your reading?" **B:** "Like helping me like read things"), elements of PT ("It [timed test] was proper good…because it's helping me like get better at words and that"), and environmental factors such as the quiet work environment (**Interviewer: "**what was it like working in that area of the classroom?" **B:** "Erm…well that was like a quiet bit so it were alright…You can just concentrate more").

Pupil B highlighted the difference between some teachers and the teachers he completed the PT sessions with:

B: "Erm, normally other teachers, they just, they're like…other teachers you get something wrong they won't like…they'll just make you wait there until you finish it…But they're [PT staff] just like you miss one word or whatever and you just keep on reading the sentence or whatever…"

This was allocated to show a stable uncontrollable external perception of control which Pupil B felt contributed towards his learning progress. Pupil B highlighted

that he felt encouraged by staff to achieve his learning goals (**Interviewer:** "What did they [teaching staff] do to help you to read things? If I saw them helping you to read something, what would I see them doing?" **B:** "Encouraging me… 'Come on you can do it' and all that"). Pupil B highlighted internal, stable and controllable aspects which impacted on learning changes. He made a number of statements regarding personal effort being needed to support learning change (**Interviewer:** "What would I see you doing or your group doing or your class?" **B:** "working harder") (**Interviewer: "**how did you feel you helped to make those changes happen to your reading?" **B:** "Paid more attention"). Therefore Pupil's B's perception of external factors as impacting his learning progress should be considered alongside his internal attributions about personal effort.

The following data was located within a locus, stability and controllability attribution matrix as proposed by Weiner (1972). This data is presented here as these attributions were repeated on a number of occasions during Pupil B's interview.

Table 5.13 Internal attributions of learning progress during PT sessions for Pupil B.

	controllable	**uncontrollable**
stable	"words that I got stuck on, and then like keep learning them and learning them until then I could do em!" (long term effort)	/
unstable	"Paid more attention" (temporary effort)	/

Table 5.14 External attributions of learning progress during PT sessions for Pupil B.

	controllable	**uncontrollable**
stable	"well that was like a quiet bit so it were alright…"	"Normally, other teachers, they just,

		they're like…other teachers you get something wrong they won't like…they'll just make you wait there until you finish it."
unstable	/	"It's [Precision Teaching] helping me like get better at words and that"

Social learning theory

Pupil B highlighted his level of competency changing ("I were getting more things right and all that"), and that this success was generalised to his wider literacy reading and tests ("I've been like on tests and in my reading I'm doing better and that"). He also identified initial difficulty with the word he was learning before they became easier ("at first it was a bit harder but then it got easier"). Pupil B highlighted that he used the chart to identify his progress (**Interviewer:** "So you did the dots on here, and what did they mean?" **B:** "Erm where I've reached and that… so it [chart] would tell me where I'd got to"). Pupil B described that he felt "in the middle" when asked about his feelings towards literacy learning, stating that literacy skills were "just a bit important" to him.

Achievement theory

Pupil B highlighted the element of competition between himself and peers (**B:** "...Like we [Pupil A, B and C] were having this little contest thing." **Interviewer:** "having a contest?" **B: "**Yeah seeing who could get the most"), describing that this prompted positive effect. Pupil B also highlighted staff encouragement ("Come on, you can do it") as helpful for his reading progress although it is not clear whether this motivated Pupil B to attribute further success to his own ability, or motivated him to succeed for staff approval. Pupil B appeared to be

very positive about the PT intervention activities and monitoring processes, specifically the probe assessments, linking these to being positive because they led to learning progress;

Interviewer: “Ok, alright. So when you were doing the sessions, what was it like doing the timed test?”
B: “It was proper good…because it’s helping me like get better at words and that”.

Pupil B reported no negative affect regarding the PT sessions. He reported positive affect following an increase in learning progress (**Interviewer:** What did that [Precision teaching session] make you feel like? **B:** Erm……happy). However Pupil B described that this may not have been transferred to his wider attitude towards literacy (**Interviewer:** “Did you notice any changes to what you were feeling about reading or was it just the same?” **B:** “Just the same”).

Pupil B described his perception of the difference between skills learned for tests, and skills learned within PT to help improve his skills, stating that the latter reason was “good”.

B: “In these sheets (*pointing to PT words and probe sheets in front of him)* they’re just like words and they’re like, they don’t really like matter…well they do for your learning and that but like…[pause]… They <u>do</u> matter but they don’t, they don’t go into like our thingys for our levels and they’re just like there to help me and that…”

Although Pupil B described the need to “get a good level”, he also mentioned the importance of literacy skills for his future (“So I can do something good with my life”), which indicated a possible motivating factor of future success. There were some discrepancies noted in Pupil B’s responses, initially giving a neutral response about the importance of literacy (**Interviewer: “**for you B, is being good at reading or at literacy, is that an important thing to you or not so important?” **B:** “I’m not bothered me”), but then linking positive feelings to an increase in achievement or success in literacy (**Interviewer:** “What did that [success in Precision teaching session] make you feel like?” **B:** “Erm……happy”). When describing the importance of achievement in literacy,

Pupil B associated this with being “a bit important”, prefacing this as important to promote good performances within tests. Negative affect was described by Pupil B when he was discussing doing spelling tests in literacy. However Pupil B reported positive affect following learning progress which he linked to being a result of PT.

5.11 Pupil C

5.11.1 Context

Pupil C attended the Year 5 class of mainstream primary L at the time of the research project, age 10 years 0 months. He had been placed on the School Action Plus register regarding limited progress in literacy with an emphasis on handwriting. Occupational Therapy had advised school on fine motor control support for Pupil C, and LA learning support was in place to promote academic progress. Although Pupil C did not display challenging behaviour in class, he appeared to become distracted and disengaged, frequently looking around the classroom and out of the window, looking towards sources of noise in the classroom rather than listening to the teacher, and not completing independent work without staff prompts approximately every 10 minutes. Pupil C's progress across Year 5 was recorded in the national curriculum levels were Reading 2C and Writing 1A+ in September 2012, and Reading 3B and Writing 2B+ in September 2013. Staff described Pupil C as being extremely motivated by staff praise, and as being willing to try any activities presented to him by staff. However independent motivation was low.

5.11.1.1 Delivery of intervention

The Precision Teaching (PT) training was delivered as described in Section 4.4.2. Pupil C used the New Nelson Handwriting programme (Smith and Inglis, 1984) used by the school. Pupil C moved through the cursive writing steps as guided by the programme. During the baseline teaching sessions he used handwriting sheets and activities focussed on handwriting repetition. During the intervention phase these activities were differentiated as Pupil C's progress was not increasing at an adequate rate as advised by the PT guidance. These changes incorporated varying activities and games to incorporate words using letter joins, and competitive games with staff.

Pupil C's progress during the PT intervention was recorded on a chart (see Appendix 31). Pupil C's aim rate was reduced due to the differing response

mode (writing) therefore requiring longer to produce items in the probe assessment. This also reflected his difficulties in fine motor control and therefore the aim rate was reviewed regularly during the intervention phase to ensure it was at the optimum rate for his ability. Performance followed a consistent pattern over subsequent blocks of words, with correct items increasing to the aim rate and incorrect items decreasing. On occasions, Pupil C did not reach the minimum number of incorrect answers. In response to this staff adapted the teaching items and methods of teaching to support Pupil C's learning. Staff also varied the items between teaching digraphs, and teaching whole words containing these digraphs in an attempt to teach pre-requisite skills before higher level skills (see Appendix 4).

5.11.2 Does Precision Teaching have an effect on Pupil C's perception of control over learning?

Visual analysis was undertaken to review the graphs created from Pupil C's MMCPC ratings. The visual analysis description and numerical analysis to elaborate on the graph elements are described separately for each control factor. Perceived unknown control data can be viewed in Figures 5.35, 5.36, 5.37, 5.38 and 5.39, with numerical data presented for this control element in Table 5.15. Perception of powerful others control data can be viewed in Figures 5.40, 5.41, 5.42, 5.43 and 5.44, whilst numerical data is presented in Table 5.16. Internal control data is presented in Figures 5.45, 5.46, 5.47, 5.48, and 5.49, with numerical data for this control element included in Table 5.17.

5.11.2.1 Pupil C perceived unknown control

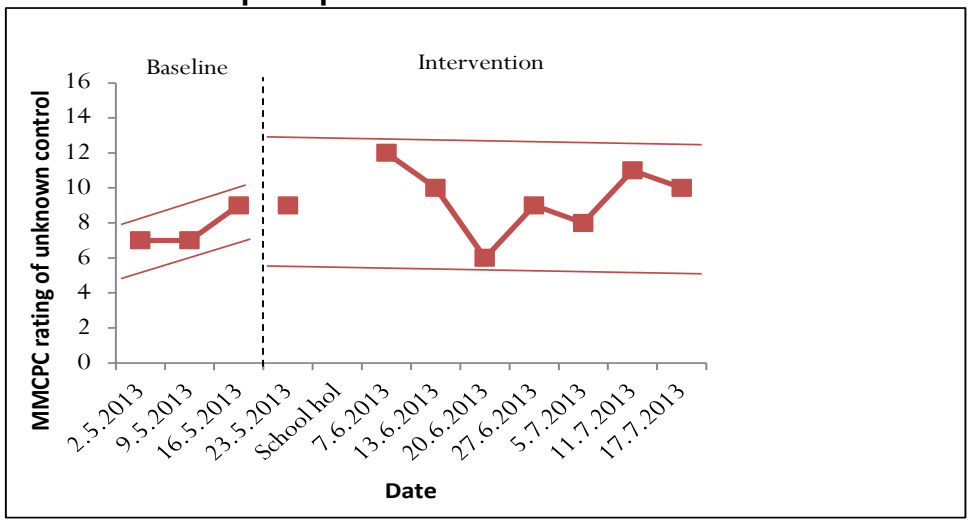

Figure 5.34 Graph to show variability in the unknown control ratings of Pupil C.

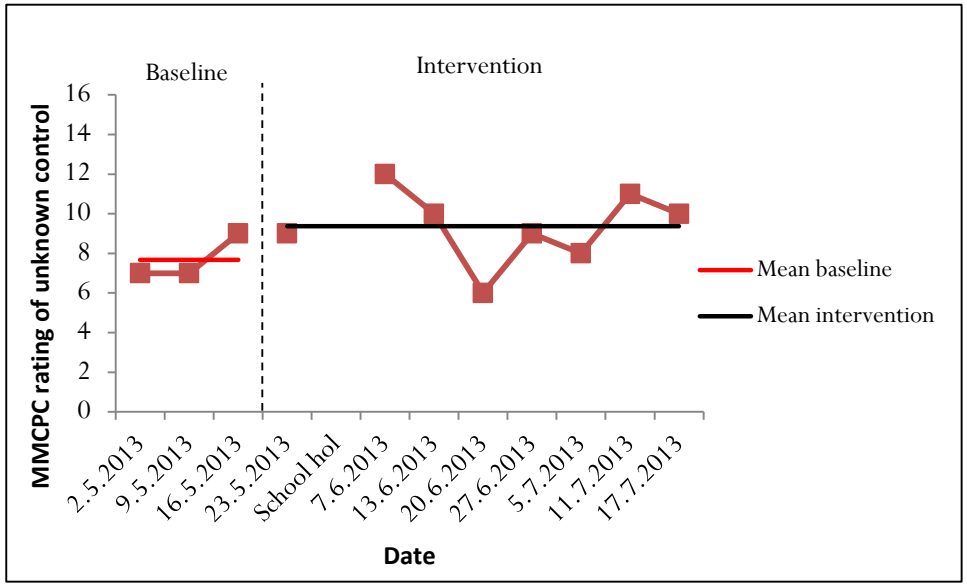

Figure 5.35 Graph to show level of unknown control ratings for Pupil C.

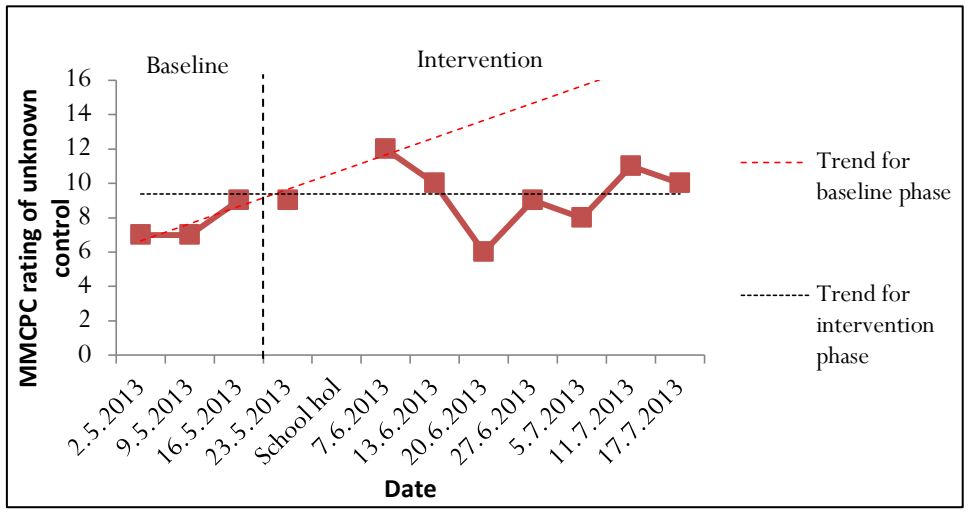

Figure 5.33 Graph to show trend in ratings of powerful others control for Pupil C.

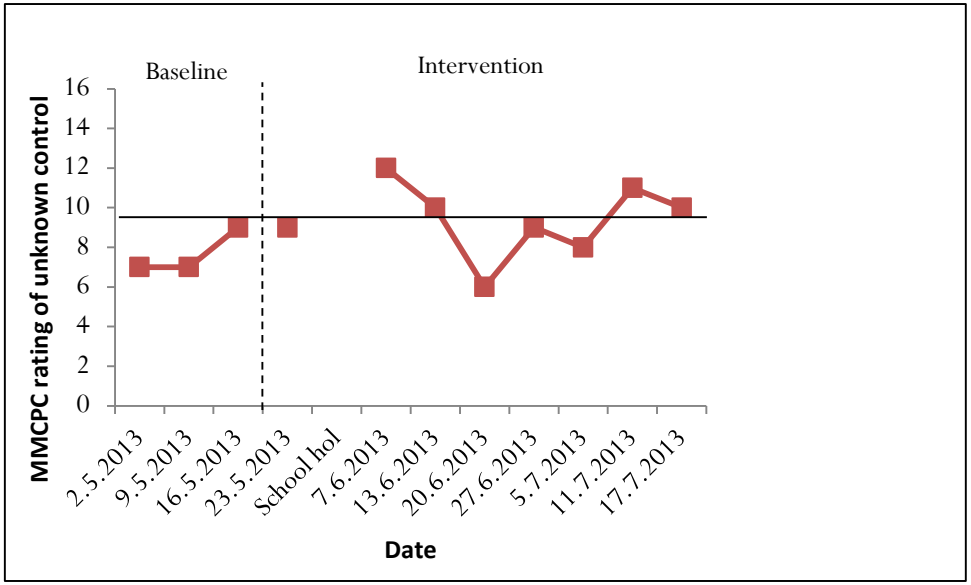

Figure 5.36 Graph to show overlap of unknown control ratings for Pupil C

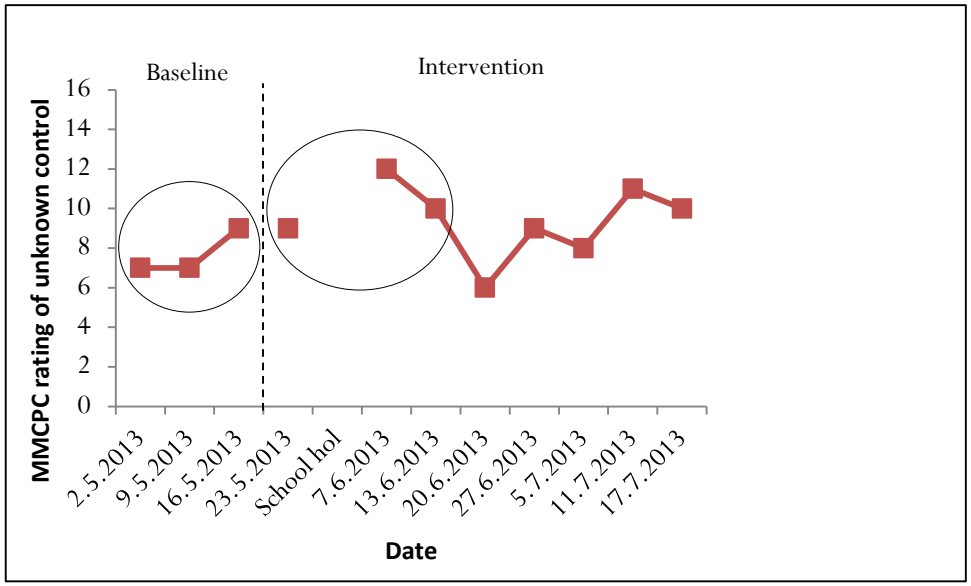

Figure 5.37 Graph to show immediacy of effect for ratings of powerful others control for Pupil C.

Table 5.15 Visual and numerical analysis summary for Pupil C: unknown control

Analysis factor	**Visual analysis description**	**Numerical measurement outcome**
Level	Within the graph the plotted average data indicate a small increase in the mean during Phase B. However this increase appears to be slightly decreased and does not represent a large average change.	Baseline mean rating: 7.666 Intervention mean rating: 9.375 Mean change: +1.709 Mean shift: 0.222
Variability	On eyeballing the data, the spread of data around the mean appear to be larger within the intervention phase than the baseline phase.	Standard deviation for Phase A: 1.154 Standard deviation for Phase B: 1.846 Variation for Phase A: 1.333 Variation for Phase B: 3.410
Immediacy of effect	The first data point in the intervention phase is identical to the last point in the baseline phase. However comparison of the three baseline data points and the first three data points in the intervention phase reveal wider variation, with the intervention data points indicating two increased ratings of unknown control.	Last Phase A data value:9 First Phase B data value:9
Overlap	There is a medium level of overlap between the data points, with six data points	Baseline phase improvement rate: 0% Intervention phase

	(54%) overlapping others in the data set across the baseline and intervention phases.	improvement rate: 50% IRD: 50%
Trend	The intervention trend as seen on the graph is stable, whilst the baseline trend shows an increasing steep gradient.	Baseline phase trend line: y = -0.0025x+9.396 Intervention phase trend line: y = 0x+5.6667

5.11.2.1.1 Pupil C unknown control inter-rater reliability

Inter-rater judgements varied in their confidence of stability of the baseline data, with two raters agreeing the data were stable, but one rater stating a neutral judgement. However the agreement level for these judgements was calculated to provide moderate reliability (k = 0.608696). Inter-rater judgements indicated a change between baseline and intervention phases with a fair reliability value (k = -0.2). However a significant change was not indicated, with two raters choosing neutral agreement, and one rater disagreeing that the difference was significant. The inter-rater judgement agreement was calculated to have a slight reliability level (k = 0.068966).

5.11.2.2 Pupil C perceived powerful others control

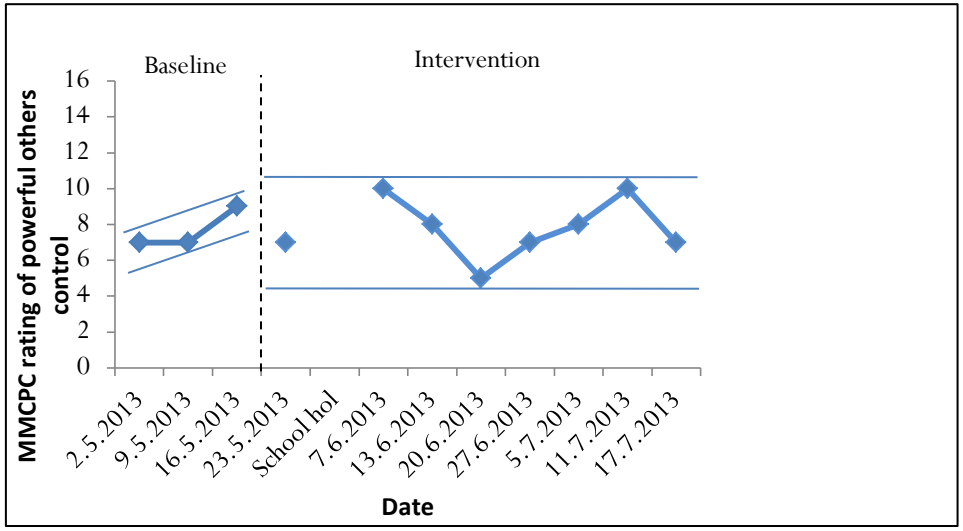

Figure 5.40 Graph to show variability in powerful others control ratings for Pupil C.

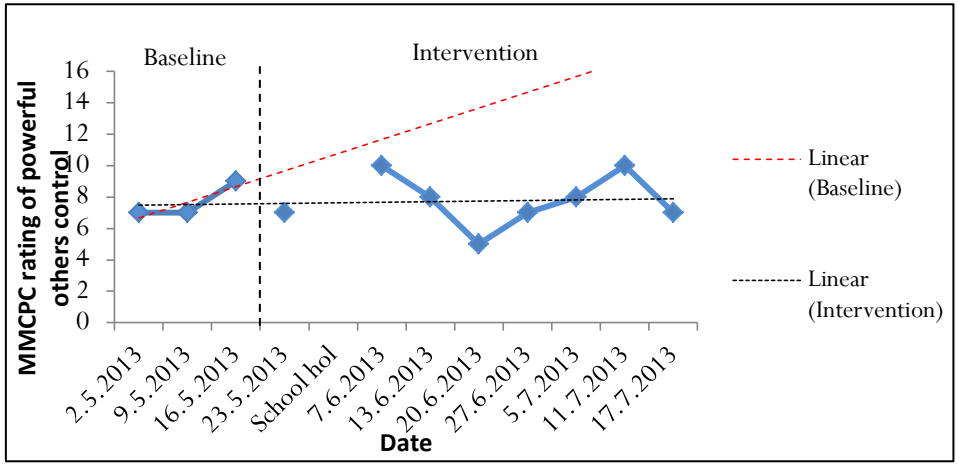

Figure 5.39 Graph to show trend in ratings of powerful others control for Pupil C.

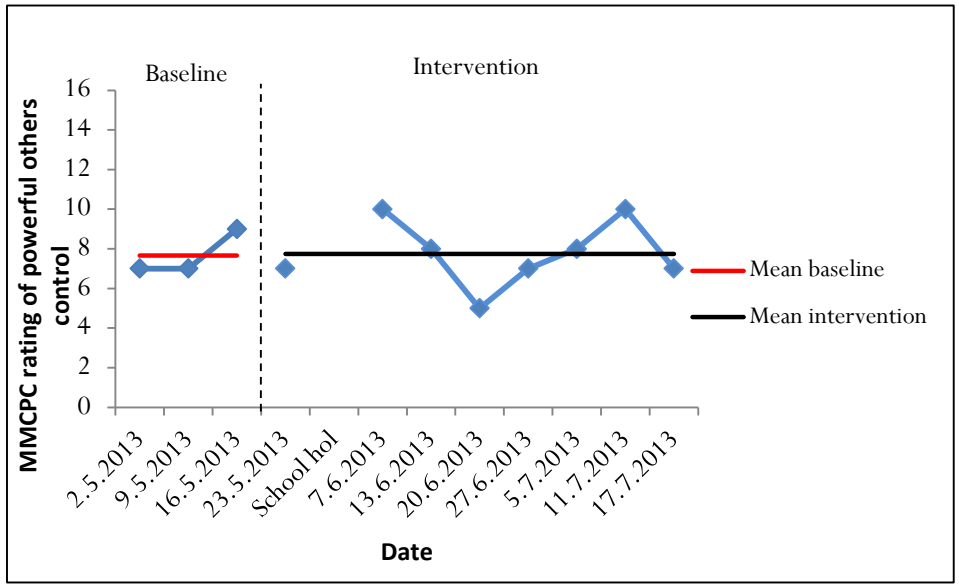

Figure 5.38 Graph to show level in ratings of powerful others control for Pupil C.

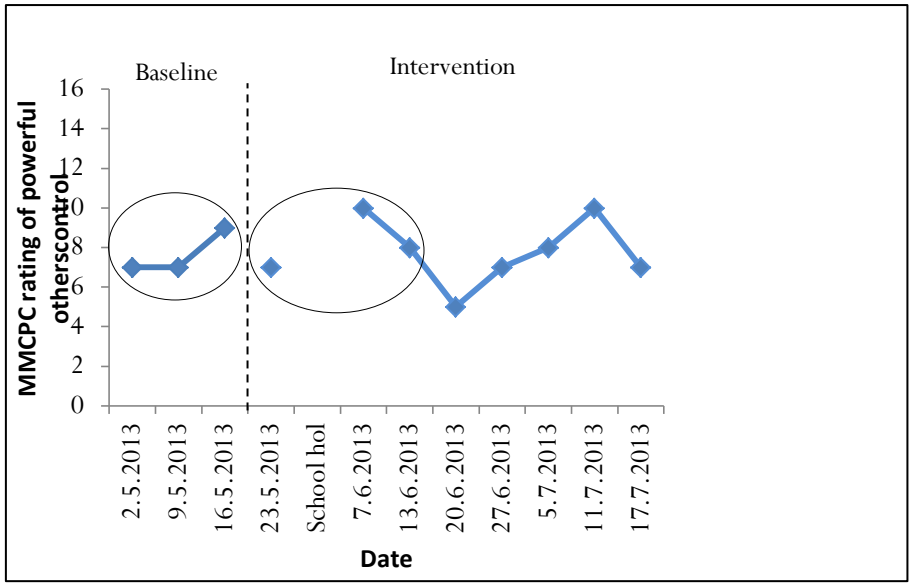

Figure 5.42 Graph to show immediacy of effect for ratings of powerful others control for Pupil C.

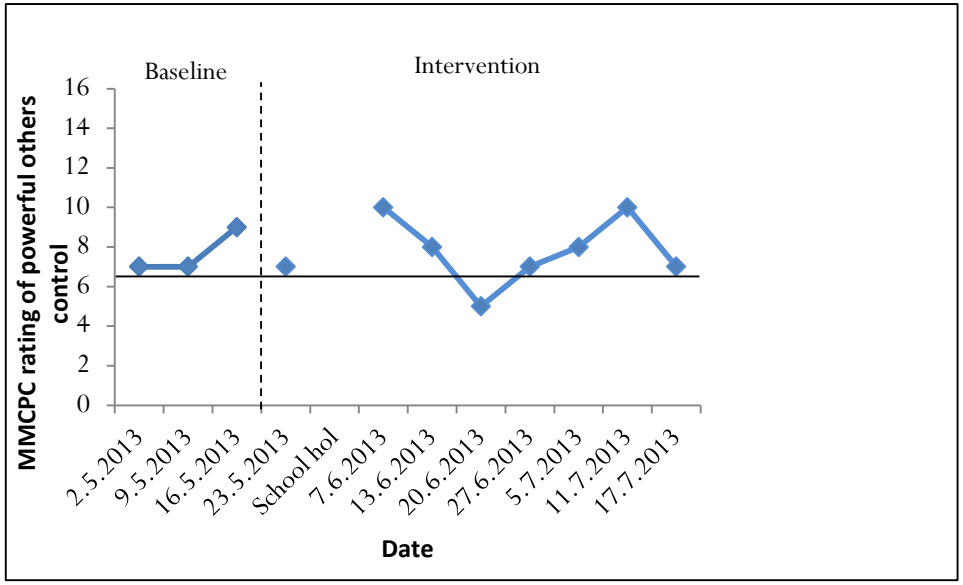

Figure 5.41 Graph to show overlap for ratings of powerful others control for Pupil C

Table 5.16 Visual and numerical analysis summary for Pupil C: powerful others control

Analysis factor	**Visual analysis description**	**Numerical measurement outcome**
Level	Through eyeballing the data there is a minimal increase change between the mean in baseline and intervention mean rating.	Baseline mean rating:7.666 Intervention mean rating: 7.75 Mean change:-0.084 Mean shift: -0.010
Variability	Variance within the intervention phase appears to be much larger than within the baseline phase data. The spread of data points around the mean in the intervention phase is broad with a changing increase and decrease in scores throughout.	Standard deviation for Phase A: 1.154 Standard deviation for Phase B: 1.669 Variation for Phase A: 1.333 Variation for Phase B: 2.785
Immediacy of effect	A decrease change of -2 was indicated in the first data point of the intervention phase. On review of the three baseline data points and the initial three data points of the intervention phase, there is a large degree of overlap with a slight increase in the third data point of the intervention phase.	Last Phase A data value:9 First Phase B data value:7
Overlap	There are a number of non-overlapping data points within the intervention	Baseline phase improvement rate: 0% Intervention phase improvement

	phase, some of these are higher and some lower than the baseline phase data points. This echoes the wider spread of data in the intervention phase than the baseline phase.	rate: 12.5% IRD= 12.5%
Trend	The baseline trend appears to show an increasing and steep gradient, whilst the intervention gradient remains stable.	Baseline phase trend line:y = x+5.6667 Intervention phase trend line: y = 0.0351x+7.4561

5.11.2.2.1 Pupil C powerful others control inter-rater reliability

Two inter-rater judgments agreed that the baseline data indicated a stable trend, with one inter-rater providing a neutral judgement regarding baseline stability. Agreement between these judgements was calculated to provide fair reliability (k = 0.25). Two inter-raters stated their agreement that there was an observable change between baseline and intervention data, with one judge providing a neutral judgement. These ratings were calculated to have a moderate level of inter-rater agreement reliability (k = 0.55). Two inter-rater judgements gave neutral agreement that a significant change was observed between the baseline and intervention phases. However one inter-rater agreed that this change was significant for this element of control. These judgements were calculated to provide a fair inter-rater agreement reliability value (k = 0.307692).

5.11.2.3 Pupil C perceived internal control

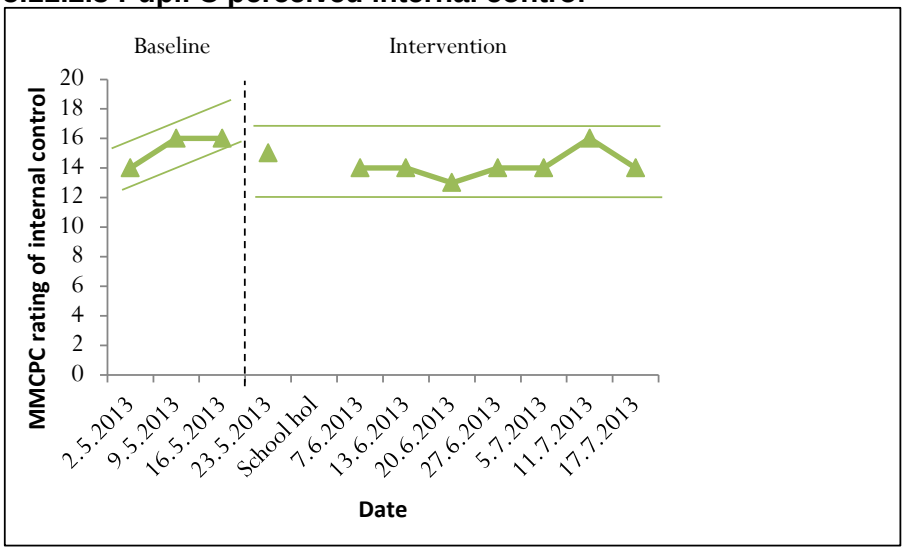

Figure 5.43 Graph to show variance in ratings of internal control for Pupil C.

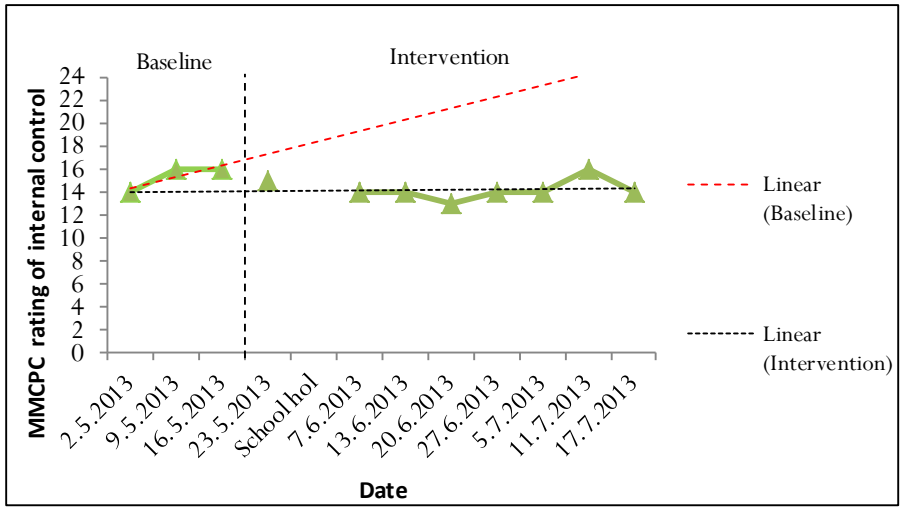

Figure 5.44 Graph to show trend of internal control ratings for Pupil C.

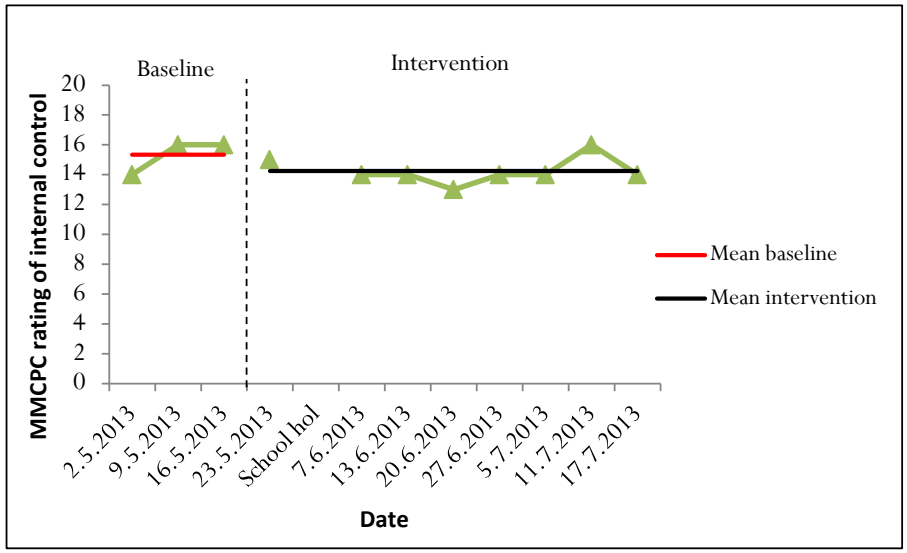

Figure 5.45 Graph to show level of internal control ratings for Pupil C.

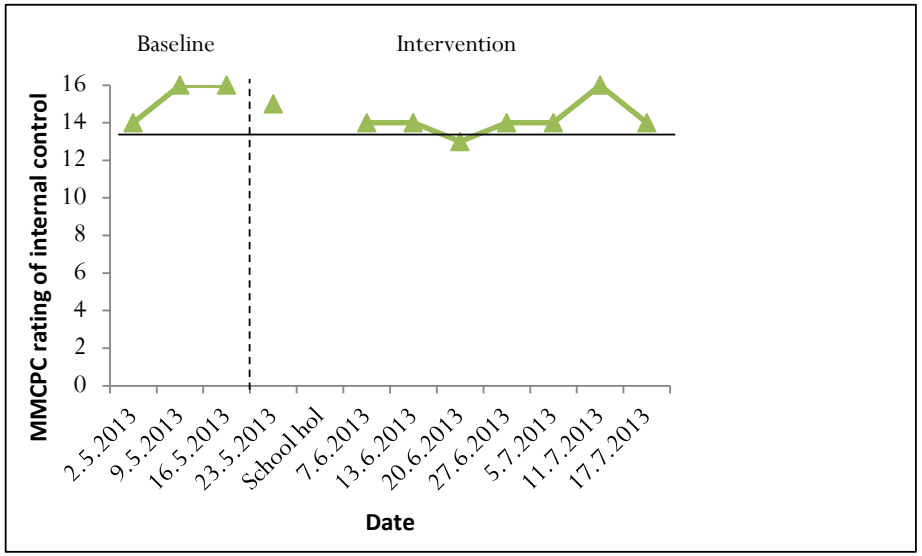

Figure 5.47 Graph to show overlap of internal control ratings for Pupil C.

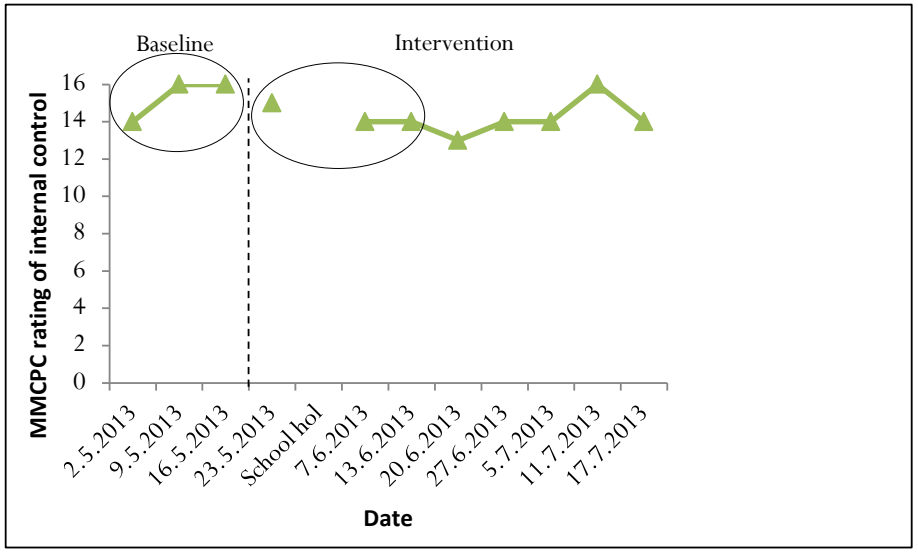

Figure 5.46 Graph to show immediacy of effect for internal control ratings for Pupil C.

Table 5.17 Visual and numerical analysis summary for Pupil C: internal control

Analysis factor	**Visual analysis description**	**Numerical measurement outcome**
Level	Within the average rating data plotted in the graph, a limited change in the mean of the baseline and intervention phases is observed. However the ratings provided by Pupil C identify a high rating of internal control indicating a ceiling effect. This rating pattern fluctuates only slightly throughout the intervention phase producing a slightly lower mean. However this remains close to the maximum rating available for this control element.	Baseline mean rating:15.333 Intervention mean rating: 14.25 Mean change:-1.08 Mean shift: -0.07
Variability	There is less variance of the data evident in the baseline phase than the intervention phase. However visual analysis of this data indicates that Pupil C's ratings of internal control fluctuate by a maximum of three rating scale points throughout the baseline and intervention phases.	Standard deviation for Phase A: 1.154 Standard deviation for Phase B: 0.886 Variation for Phase A: 1.333 Variation for Phase B: 0.785
Immediacy	The three data points in the	Last Phase A data value:16

of effect	baseline and initial three data points in the intervention phase fully overlap therefore indicating no evidence of an immediate effect of Precision Teaching on the perception of internal control over learning for Pupil C.	First Phase B data value:15
Overlap	Data points in both the baseline and intervention phases overlap fully with the exception of one intervention phase data point (overlap of 90.9%).	Baseline phase improvement rate: 0% Intervention phase improvement rate: 12.5% IRD = 12.5%
Trend	Through eyeballing the data, the intervention linear trend line indicates an increasing trend with a relatively steep gradient. In comparison to this, the intervention phase trend line remains stable.	Baseline trend line: y = x+13.333 Intervention trend line: y = 0.0251x+14.04

5.11.2.3.1 Pupil C internal control inter-rater reliability

Two inter-rater judgements indicated that the baseline data was stable, with one judge providing a neutral judgement. These ratings were calculated to provide a fair agreement reliability value (k = 0.3333). However, inter-rater judgements indicated neutrality or disagreement that a change was present between baseline and intervention data. These agreements were calculated to have a fair agreement level (k = 0.307692). It therefore followed that a significant change between data phases was also not agreed within inter-rater judgements, with this producing a fair agreement reliability value (k = 0.37931).

5.11.2.4 Summary of MMCPC rating results

Within perception of powerful others control, Pupil C's mean rating during the baseline and intervention phases are similar. Inter-rater judgement agreed that although a change is present between phase data, this change is not significant. This reflects the increased variance present in the intervention phase; the conclusions that can be drawn from this data are therefore unclear.

Pupil C rated his initial perception of unknown control within the baseline phase at a medium level, with a mean of 7.6. However variance across the intervention phase data is increased. This variation indicates some change in responses during the intervention phase, which could be attributed to the introduction of PT. The trend line within the intervention phase remains stable, however it is steadily increasing in the baseline phase. This could indicate that the intervention phase inhibited the upward gradient of this trend and produced a more stable set of ratings. However the baseline trend is based on three data points and therefore the validity of this predicted trend could be questioned. PT may have some impact on unknown control for this pupil but this was not indicated to be a significant increase or decrease change. The pattern of responses for unknown and powerful others control are similar across the data set.

Pupil C's internal control ratings appeared to show limited change in the mean level between the baseline and intervention phases. Ratings begin at a high level and there are small variance and standard deviation calculations for both phases. The high level of overlap (90.9%) indicates a non-change between baseline and intervention phases as reflected in inter-rater judgements. It could be inferred that the perception of internal control was not impacted by the implementation of PT. However Pupil C's ratings were at a ceiling level within the baseline phase and therefore may not be fully representative of Pupil C's views.

5.11.3 Does Precision Teaching have a positive effect on academic self-perception for Pupil C?

Myself as a Learner (Burden, 1999)

Pupil C produced a pre-test score or 83 and post- test score of 76, with a decrease difference between Time 1 and Time 2 of -7. The RCI score of -9.21 indicates that this decrease change between these time points is significant. The RCI score calculated for the change between pre and post MALS values exceeds the significant difference statistic stated within the reliable change index literature (Speer, 1992). Although a decreased MALS score is evident (see Figure 5.50), both of these scores remain within the range of scores specified by the MALS measure to indicate a positive level of self-efficacy towards learning.

Staff views were gained following the intervention phase. Staff reported that Pupil C initially found it difficult to achieve the aim rate during the PT sessions, and that this had to be lowered to reflect the difficulty he was having. Staff did not describe a lessening in Pupil C's engagement with the sessions, or any reluctance to take part in the writing activities which may have been associated with a decrease in his feelings of confidence and self-efficacy towards his literacy learning. Staff reported that Pupil C initiated verbal feedback to them that he enjoyed writing during the sessions and that he felt he was making improvements. Staff reported that Pupil C was extremely motivated by staff praise and recognition of achievement. They also described that Pupil C continued to require prompts in wider literacy and curriculum lessons, and did not noticeably change his initiation of task completion during this time.

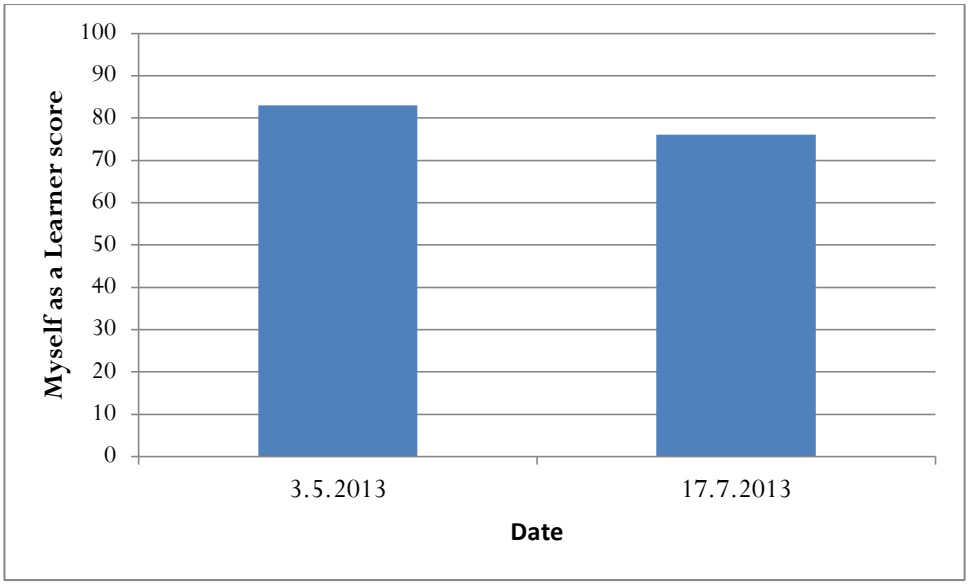

Figure 5.48 Graph to show change in MALS score for Pupil C

5.11.4 How might Precision Teaching have impacted motivation towards literacy for Pupil C?

Views were obtained during an interview between Pupil C and the researcher. The full thematic analysis of this can be found in Appendix 23, theoretical code produced to analyse the data is described in Section 5.4.4.

Attribution theory

Pupil C's responses indicated some perception of internal attributions regarding success ("I got a bit quicker…and a bit neater") and internal attributions for the cause of lack of progress ("oh there I got muddled up" [*Pointed to work sheet*]). Pupil C appeared to locate some causes of learning changes externally, describing staff as supporting his learning through the PT resources

C: "Well, Mrs H did this to make my handwriting quicker and neater."
Interviewer: "And what is this, what did they do?"
C: "Well…[*Indicates timed test probe sheets*]".

Pupil C did not report any internal elements which could be defined as uncontrollable, instead indicating an understanding of learning outcomes

resulting from controllable factors such as individual effort and practice (**Interviewer: "**So when you did practice at home, or when you were doing your handwriting in school, why did you do it?" **C:** "Well so that my handwriting's better"; **C:** "we wrote stories…practiced when I read and at home"). Instability indicates that learning can change; Pupil C identified his changing learning progress consistently within this interview (**C:** "Well it looks more neater than the others…what's in the books and there and there *(pointing to different work sheets)*…and there…well there it gets a little bit done, but there I got a whole line done"), thereby indicating the perception that his level of fluency was changed during the PT sessions.

The following interview data was located within a locus, stability and controllability attribution matrix as proposed by Weiner (1972). Statements presented here are attributions that were repeated on a number of occasions during Pupil C's interview.

Table 5.18 Internal attributions of learning progress during Precision Teaching sessions for Pupil C

	controllable	**uncontrollable**
stable	"I still do need to work on my handwriting (longer term effort)"	/
unstable	"Well it looks more neater than the others…what's in the books and there and there (*pointing to different work sheets)*…and there…well there it gets a little bit done, but there I got a whole line done" (change in learning ability linked to effort)	/

Table 5.19 External attributions of learning progress during Precision Teaching sessions for Pupil C.

	controllable	**uncontrollable**
stable	"There were these *(pointed at worksheets)* working on my handwriting" (repeated predictable skills practice)	"first they [staff] showed me what to write" (external support for learning)
unstable	/	Interviewer: "Ok what was it like when there were other teachers there working at the same time?" Pupil C: "Get distracted a bit" (unpredictable environmental factor)

Social learning theory

Pupil C indicated some external social motivators such as teacher expectations (**Interviewer:** "why is it [literacy] important?" **C:** "So my teacher will know what I'm saying"), and wider school requirements (**Interviewer:**..."if you got no marks what would happen?" **C:** "Well, I'd go down…"). Pupil C also indicated some examples of awareness of failure and the social consequences of this;

C: Do you feel like being good at your handwriting or literacy generally is important?
C: Yeah!
Interviewer: Why, why is it important?
C: So my teacher will know what I'm saying

Interviewer: So that the teacher will know what you're saying. And why is that important, how come?
C: Well because if the teacher doesn't know what I'm saying, well how does she know what I'm putting, and like if she, like in an exam to see like in a writing exam and I've got to write it down and she don't know what I'm saying cos it's not neat, I'll get done, I'll just get no marks.

Pupil C indicated that he felt it was important to get as good a mark as his peers indicating a degree of social comparison. However further exploration of this element of the interview indicated that in addition to social comparison, there may be a social focus for Pupil C to achieve literacy goals:

I**nterviewer:** "And why is it important for you to get a good mark?"
C: "Well, cos if I've got the same marks as my friend and then we go to the same secondary school as me, then I might be in the same class as them".

<u>Achievement theory</u>

Pupil C reported that he observed changes in his learning through looking at his PT chart, linking these changes to positive affect;

I**nterviewer:** "what did it feel like when you were doing the sessions and you were doing you handwriting and you saw at the end that your green line was going up?"
C: "Well, it makes me feel good."
Interviewer: "Mmm, why did it make you feel good?"
C: "Because it showed that my handwriting's getting better."

Pupil C indicated that challenge was present within the PT sessions (**Interviewer:** "Yeah, what was it like learning new letters or trying to make those letters even neater? What was that like?" **C:** "Er…a bit harder"). However he linked challenge with positive affect, describing it as "fun", (**Interviewer:** "**…**and why was that fun to play with Mrs H?" **C:** "Because she were thinking of some difficult words…and she don't give me any clues").

Pupil C then linked positive feelings with making progress (**Interviewer: "**What made it kind of fun, coming across a new letter?" **C:** "Well because so you know

how to join it, and then you try to make it neater"). He also predicted that he would have felt bored if challenge had not been present during the sessions ("If it were easy it would have been boring"). Pupil C also indicated an internal driver for achievement, stating "it makes me feel happy because I'm proud of myself". Negative affect was described by Pupil C when he was discussing doing spelling tests in literacy which was contrasted with the "fun" experience he described whilst completing assessment during PT. Pupil C indicated a drive to achieve and a link between positive affect and achievement. The interview data suggests elements of internal (i.e. feeling proud) and external (teacher expectations) affecting his motivation towards literacy.

5.12 Pupil D

5.12.1 Context

Pupil D attended Year 6 in mainstream primary S at the time of the research project, aged 11 years and 0 months. He had been placed on the School Action Plus register regarding low levels of progress in literacy despite additional interventions throughout school. He had received previous LA learning support. Pupil D was receiving assessment for a diagnosis of dyslexia and as such used additional dyslexia aids in school. Staff stated that Pupil D found literacy extremely difficult and appeared to display low self-esteem and low motivation in this subject as indicated by not initiating giving answers to the class in literacy, under-confidence when reading in groups, and not asking for help when he experienced difficulties. Staff reported that Pupil D was quick to notice his difficulties and was slow to engage in activities he perceived would be difficult. Pupil D's literacy progress levels during Year 6 were September 2012 Reading 3C, Writing 3C. In July 2013 Pupil D's academic levels were Reading 4, Writing 3A.

5.12.1.1 Delivery of intervention

Pupil D completed a computer based phonics programme (Big Cat, Collins Education) during the baseline phase. This phonics programme was completed for 15 minutes on four occasions each week, with staff also supporting him in 1-1 sessions with blending and segmenting the sounds in the programme on a number of occasions per week. As such baseline measures were taken whilst Pupil D was receiving the phonics based programme. However during the third week of the baseline phase (w/b 16.5.2013), staff discussed the possibility of changing the focus of the sessions to HFW. This was as a result of Pupil D's low spelling performance on his SATS papers, and staff feedback that Pupil D was resistant to doing further work on phonics skills and preference to work on spellings. The focus of sessions thus changed to HFW. Pupil D completed one week of baseline whilst completing sessions on HFW spelling before the intervention phase began. In addition Pupil D ceased to take part in the Big Cat phonics programme for this week of baseline.

Pupil D's progress during the PT intervention was recorded on a chart (see Appendix 32). Pupil D's performance followed a consistent pattern over subsequent blocks of words, with correct items increasing and incorrect items decreasing to the aim rate before a new block of words were introduced. Pupil D appeared to find it difficult to eliminate errors and therefore the aim rate was decreased. This appeared to have a positive effect especially when matched with including non-similar words in the block of taught items. However Pupil D then appeared to reach the aim rate quickly during subsequent blocks of words. This was discussed with the TA to explore increasing the level of challenge for Pupil D. Pupil D continued to achieve this increased aim rate in a short space of time which may have indicated less challenge than may have been optimal for his engagement. The TA also alternated the games being used to support Pupil D's engagement and interest.

5.12.1.2 Reliability and validity requirements

The changes to Pupil D's intervention and the removal of the phonics sessions make analysis of any changes between Phase A and Phase B vulnerable to validity errors such as history. The removal of the BigCat intervention and introduction of high frequency word spellings were in place for the last week of the measured baseline phase and therefore not in place long enough to produce a consistent pattern of motivation before PT was introduced. The changes occurring whilst the baseline phase was completed decreases the likelihood that a stable baseline could be reliably gained. One valid data point within the baseline did not meet the minimum number stipulated by SCED literature (Kratochwill, et al., 2010). This led the researcher to eliminate the possibility of using this data as a comparison with the intervention phase data. Therefore although the graphs are described below, this is a highly tentative description and any direct effect of PT is not confidently asserted and should be analysed with utmost caution due to the lack of consistency in the baseline intervention. As a result description of the mean shift, immediacy of effect and overlap between data points were removed from the discussion of Pupil D's numerical data as these are direct baseline-intervention comparisons.

5.12.2 Does Precision Teaching have an effect on Pupil D's perception of control over learning?

Graphs are presented below for each control factor individually as measured by the MMCPC. Tabulated discussion of these factors follows the graphs. Perceived unknown control data can be viewed in Figures 5.51, 5.52, 5.53, and 5.54, with numerical data presented for this control element in Table 5.20. Perception of powerful others control data can be viewed in Figures 5.55, 5.56, 5.57, and 5.58, whilst numerical data is presented in Table 5.21. Internal control data is presented in Figures 5.59, 5.60, 5.61, and 5.62, with numerical data for this control element included in Table 5.22.

5.12.2.1 Pupil D perceived unknown control

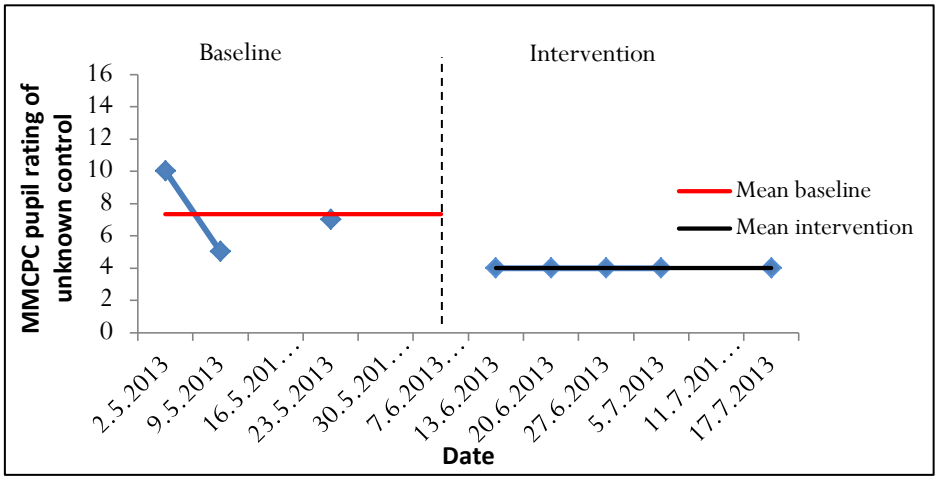

Figure 5.52 Graph to show level of unknown control ratings for Pupil D

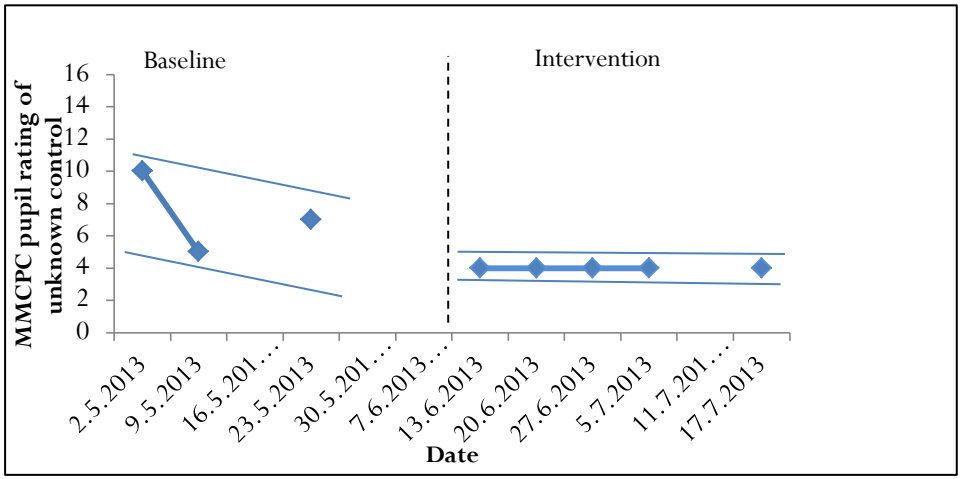

Figure 5.49 Graph to show variance in unknown control ratings for Pupil D

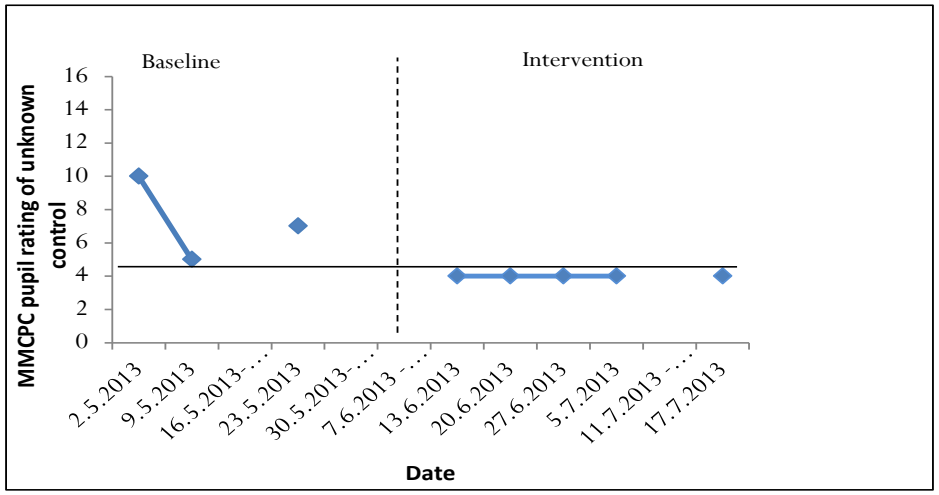

Figure 5.51 Graph to show overlap in ratings of unknown control for Pupil D

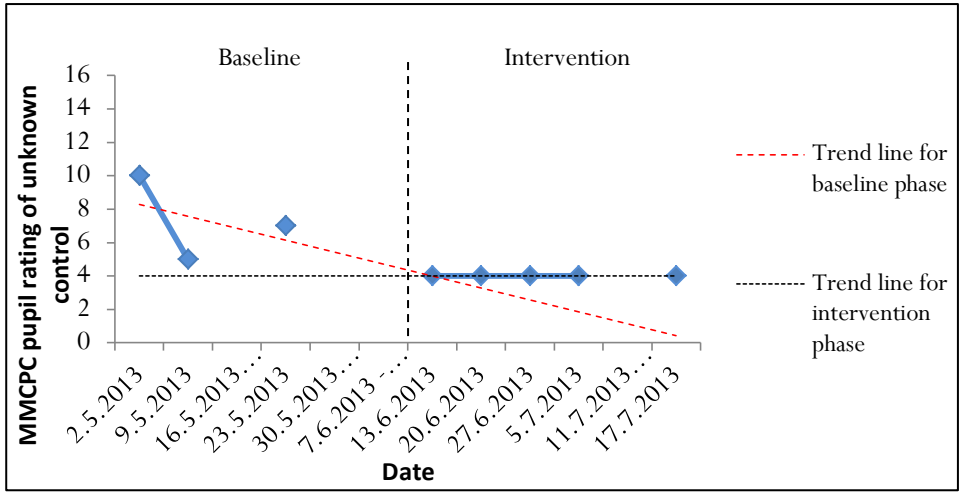

Figure 5.50 graph to show trend in unknown control ratings for Pupil D

Table 5.20 Visual and numerical analysis summary for Pupil D: unknown control

Analysis factor	**Visual analysis description**	**Numerical data**
Level	Within the intervention phase, the pupil produces ratings of 4 throughout which is the lowest score available.	Intervention phase average rating: 4
Variability	Within the intervention phase, there is no variation within the data as all reported scores are at 4.	Intervention phase variance: 0 Intervention standard deviation: 0
Trend	Within the intervention phase, the trend line continues at a low stable level	Intervention phase trend line: y = 4

5.12.2.2 Pupil D perceived powerful others control

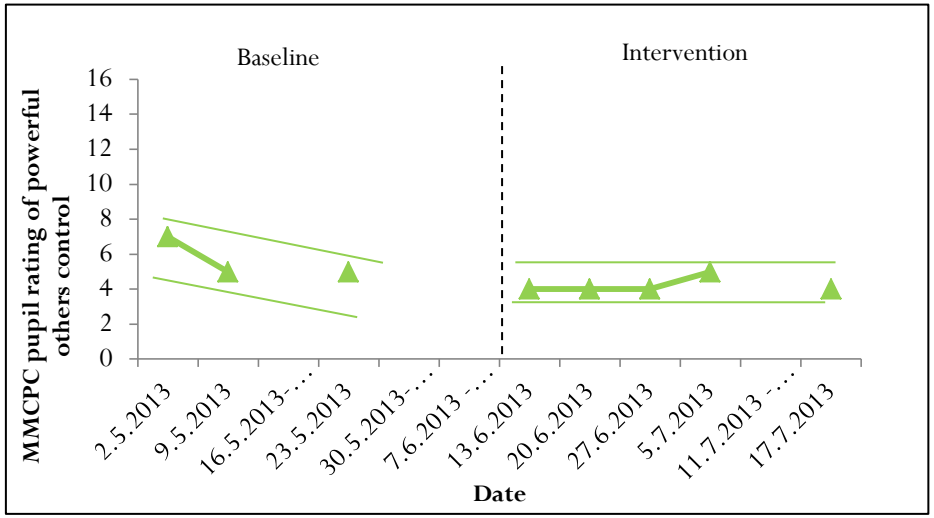

Figure 5.56 Graph to show variance in ratings of powerful others control for Pupil D

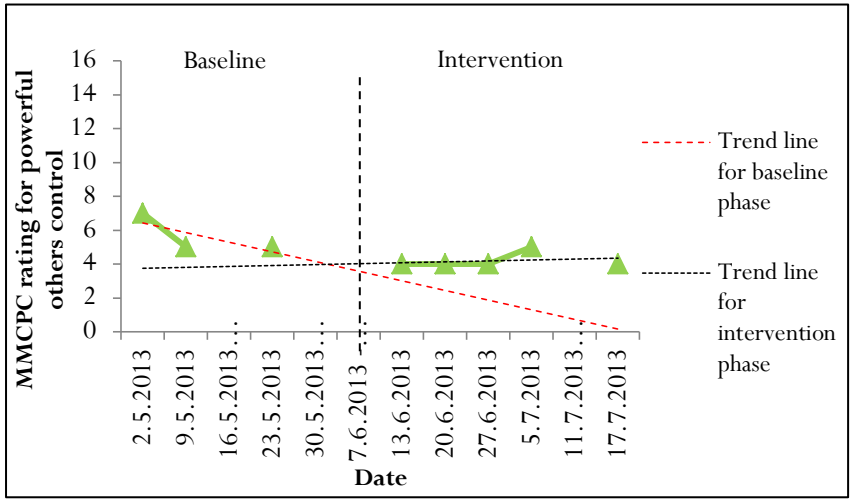

Figure 5.53 Graph to show trends in ratings of powerful others control for Pupil D

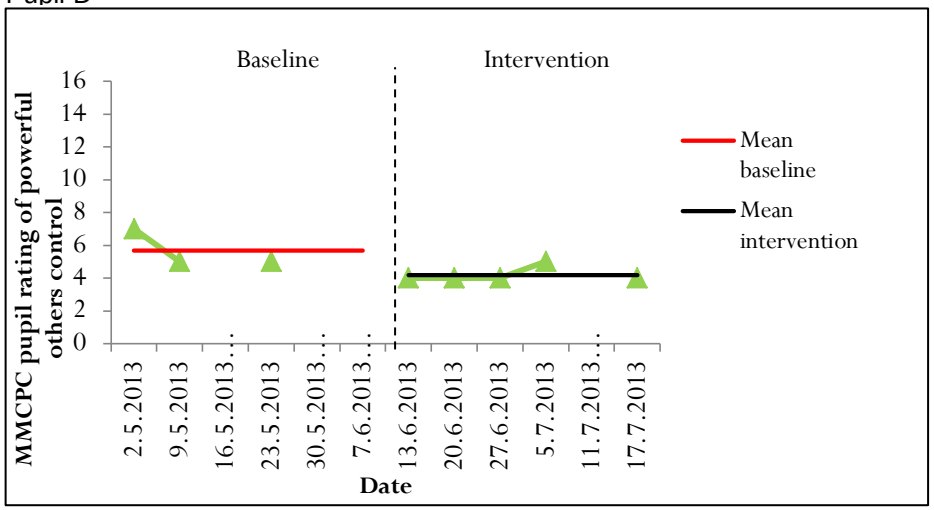

Figure 5.55 Graph to show level in ratings of powerful others control for Pupil D

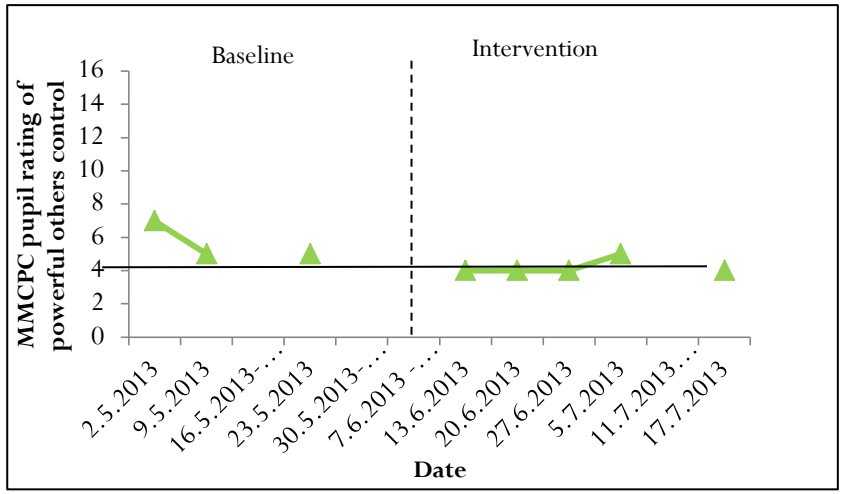

Figure 5.54 Graph to show overlap in ratings of powerful others for Pupil D

Table 5.21 Visual and numerical analysis summary for Pupil D: powerful others control

Analysis factor	**Visual analysis description**	**Numerical data**
Level	Within the intervention phase, the mean rating is low.	Intervention phase average rating: 4.2
Variability	Through eyeballing the data, variance within the intervention phase is small, with a difference between the maximum and minimum points of two rating points.	Intervention phase variance: 0.2 Intervention standard deviation: 0.447
Trend	On visual analysis of the trend lines on the graph, the intervention phase trend line appears to be stable with a very slight increase in the slope gradient.	Intervention phase trend line: y = 0.0541x+3.702

5.12.2.3 Pupil D perceived internal control

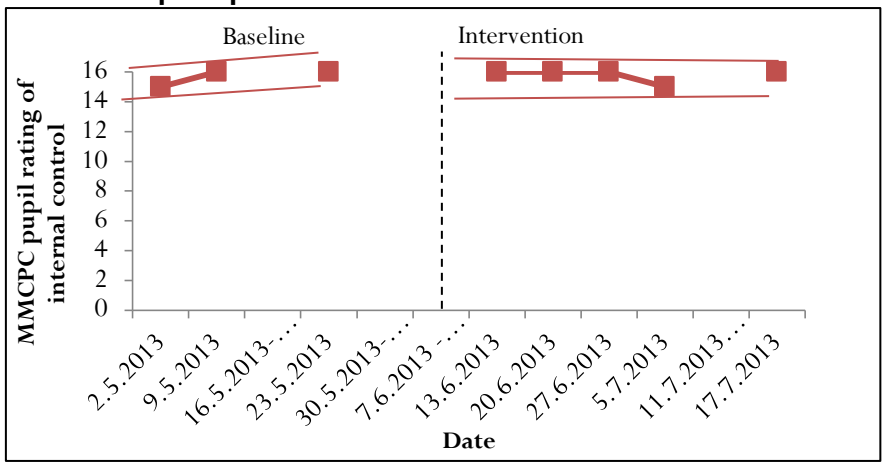

Figure 5.59 Graph to show variance in ratings of internal control for Pupil D

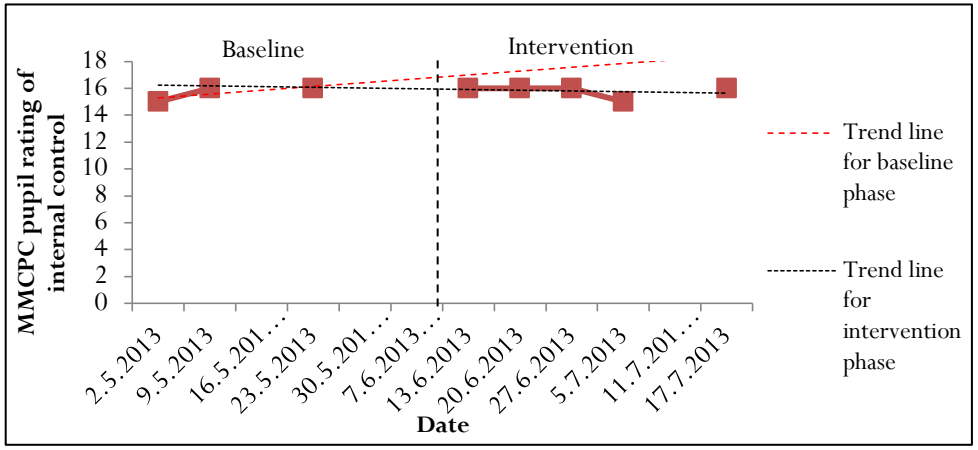

Figure 5.58 Graph to show trend in ratings of internal control for Pupil D

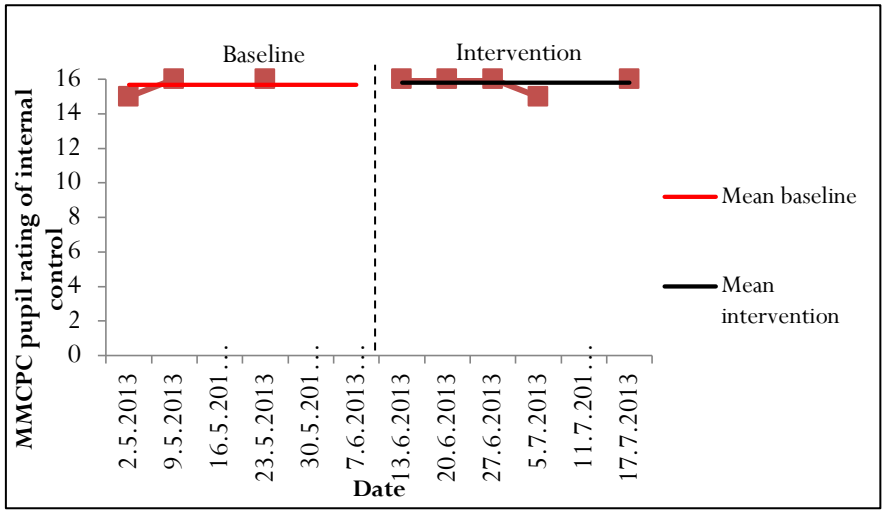

Figure 5.57 Graph to show level of ratings of internal control for Pupil D.

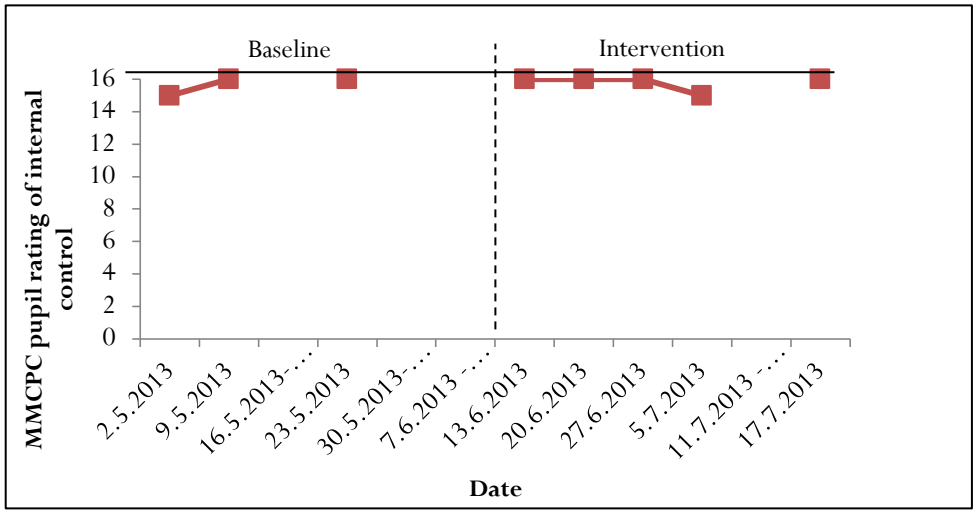

Figure 5.60 Graph to show overlap in ratings of internal control for Pupil D

Table 5.22 Visual and numerical analysis summary for Pupil D: internal control

Analysis factor	**Visual analysis description**	**Numerical data**
Level	The intervention average rating is extremely high. Data points are tightly packed around the means rating in this phase.	Intervention phase average rating: 15.8
Variability	When eyeballing the data, the intervention phase appears to show a low level of variance, with all scores being close to or at the highest rating available within the measure used.	Intervention phase variance: 0.2 Intervention phase standard deviation: 0.447
Trend	Through visual analysis of the intervention trend line as represented on the graph, the intervention phase trend line remains at a stable high level throughout.	Intervention phase trend line: y = 0.285x+15

5.12.2.4 Summary of MMCPC ratings for Pupil D

Pupil D displayed low scores of unknown control within the intervention phase, with scores decreasing to the lowest score available within the measure. This indicates that Pupil D did not perceive learning changes to be a product of unknown elements of control. Pupil D also displayed low ratings of powerful others control during the intervention phase. This indicates that Pupil D perceived learning changes were not impacted by the effect of powerful others within his context. Pupil D appeared to have a high level of internal control as measured by his ratings in the MMCPC. These ratings remained at a ceiling

level throughout the intervention phase and deviated only slightly in a decreased direction during the fourth week of the intervention phase. Within Pupil D's ratings of powerful others control, there appeared to be a small increase in the fourth week of the intervention phase as contrasted with a corresponding decrease in internal control ratings. It should be noted that ceiling effects may have impacted on the responses of Pupil D in internal ratings of control.

Due to the inconsistency of the baseline intervention, it is difficult to be confident that PT had any direct impact on these ratings. Highly tentative analysis of the intervention phase data may indicate that Pupil D appears to have a high perception of internal control over success and failure outcomes in his learning, with a perception of unknown and powerful others as having a minimal impact on his learning outcomes.

5.12.3 Does Precision Teaching have a positive effect on academic self-perception for Pupil D?

Myself as a Learner Scale (Burden, 1999)

The pre-test score or 63 and the post-test score of 71 reveals a difference of +8 between Time 1 and Time 2 data gathering points as shown in Figure 5.63. The RCI score of 10.52 indicates a significant change between the pre and post test scores for Pupil D's performance in the MALS. Although Pupil D produced a score within the average range of scores indicated by the measure, the higher Time 2 score places him more firmly within this average range. This indicates that Pupil D's feelings of self-efficacy towards his learning may have improved between Time 1 and Time 2, although clinical significance would need to be identified through analysis of triangulation of quantitative and qualitative data. It should also be acknowledged that any conclusions regarding PT as a cause of change between these pre and post test scores should be interpreted with caution, as control between the baseline and intervention phases was compromised.

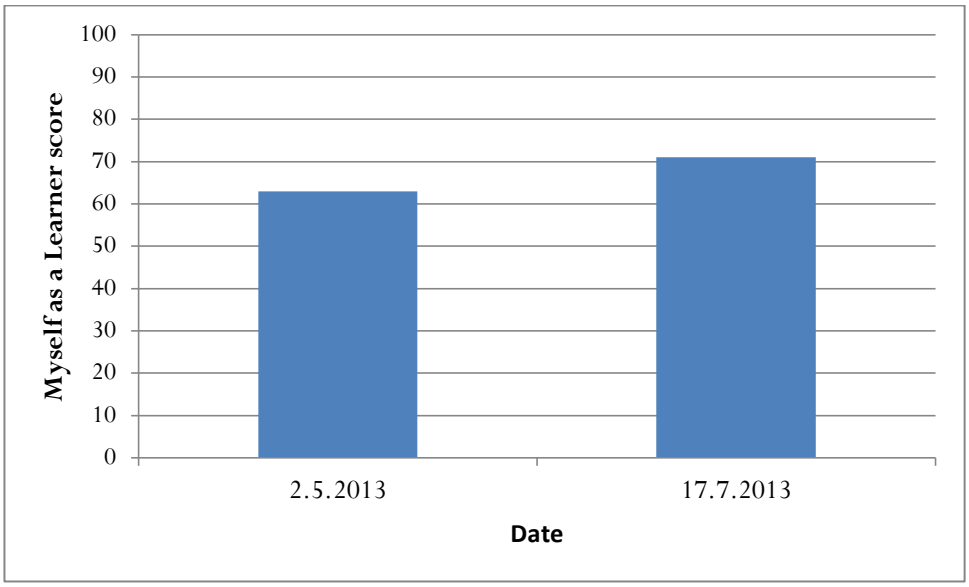

Figure 5.61 Graph to show changes in MALS score for Pupil D

The TA working with Pupil D reported that the activities used within PT sessions had to be carefully tailored to him. Initially, the TA used competitive elements within activities to promote competition. However Pupil D responded negatively to this. The TA reported that she perceived Pupil D to become extremely de-motivated by this as he perceived he would lose any competition as his opponent was more skilled than him. However the TA stated that timed activities and the timed probe assessment appeared to support Pupil D's engagement and he appeared to enjoy the timed element and competition against himself. The TA reported that during the PT sessions, Pupil D appeared to be pleased when he was able to beat his previous score, and was motivated to beat his target aim rate.

5.12.4 How might Precision Teaching have impacted motivation towards literacy for Pupil D?

Views were obtained during an interview between Pupil D and the researcher. The full thematic analysis of this interview can be found in Appendix 24. The theoretical code produced to analyse this data is described in Section 5.4.4.

Attribution theory

Pupil D appeared to reject broad external attributions for learning changes relating to staff input (**Interviewer: "**Did Mrs Y do something to help those changes to happen?" **D:** "No." **Interviewer:** "No? Mrs Y didn't do anything to make those changes happen?" **D:** "Well she organised it and that's about it"). However he did describe staff behaviour which he perceived supported his learning:

Interviewer: "What was Mrs Y like as a teacher? What did she do?"
D: "Doesn't shout".
Interviewer: "...And what did you like about that she didn't shout?"
D: "Learnt a lot."
Interviewer: "Why if a teacher doesn't shout do you learn more?"
D: "Because you get to concentrate and you get to hear what they say".

Pupil D appeared to perceive that this behaviour supported his concentration and this in turn helped him to learn. A limited number of internal attributions for learning progress were acknowledged by the pupil within this interview, although he appeared to link his effort with making progress:

Interviewer: "so why would you need to concentrate on your spelling?"
D: "To improve".

He identified no internal attributions as a cause of the progress he made (**Interviewer:** Ok, do you think that you did anything to make those changes happen with your spelling? **D:** No). Pupil B also appeared to indicate some unknown attributions regarding changes in progress (**D:** Every week we did so many words and then just got better at it").

Pupil D's responses in the interview appeared to suggest that he felt PT had improved his learning, and that PT had made his learning success feel unstable (changeable) and controllable (he had control over how his learning was changing). The following interview data was located within a locus, stability and controllability attribution matrix as proposed by Weiner (1972). This data is presented here as these attributions were repeated on a number of occasions during Pupil C's interview.

Table 5.23 Internal attributions of learning progress during Precision Teaching sessions for Pupil D

	controllable	**uncontrollable**
stable	Interviewer: how did you learn that word? Pupil D: We used it over and over again. (personal long term effort)	/
unstable	Interviewer: If I saw you concentrating, what would I see you doing? Pupil: Working	/

	(temporary effort)	

Table 5.24 External attributions of learning progress during Precision Teaching sessions for Pupil D.

	controllable	**uncontrollable**
stable	Interviewer: What about the level of difficulty staying the same made it better in those sessions? Pupil D: I made progress (PT promoted stable level of challenge)	Every week we did so many words and then just got better at it (unknown cause of success)
unstable	**Interviewer:** Ok, could anything have made it more exciting or better, or less boring? **D:** Read better words.	/

Social learning theory

Pupil D indicated his awareness of the progress he had made in his literacy skills (**D:** "I made progress"), and that PT had supported his understanding of progress (**D: "**when I did spelling tests she *(Mrs Y)* always used to mark me work and then I didn't used to get a lot and then I started doing that *(PT sessions),* then she saw a change in my work").

Pupil D also identified that these skills had improved within wider activities (**D:** "now I can spell words in my planner"), which may have impacted on his level of expectancy for development of his literacy skills and future success in this academic area.

Pupil D highlighted comparison with his peers on a number of occasions, indicating his awareness that his level of achievement was lower than that of his peers (**D:** "Cos when I were with the rest of the class doing my spelling test we

normally did 30 and the best I did I got 15, and everybody else were getting in 20s"). Pupil D appeared to highlight that his attitude towards learning and achievement is motivated by producing scores that are within the typical range of his classmates

D: "Highest I ever got was 30 in 2 minutes… no 35, with none wrong!"
Interviewer: "mmm wow! What did that make you feel like?"
D: "Happy."
Interviewer:..."Why would that make you feel happy?"
D: "Cos I got the score what they were doing in class".

Pupil D identified that literacy holds value and is important to learn (**Interviewer:** "And is being good at literacy important for you?" **D:** "Yeah") but did not indicate further reasons for this importance despite exploratory questions around this subject (**Interviewer:** "mmm, how come?" **D:** "Because literacy is probably one of the most important subjects").

Achievement theory

Pupil D appeared to be aware of the need to make progress and use personal effort to do so (**Interviewer:** "Ok, so why would you need to concentrate on your spelling?" **D:** "To improve"). In accordance with achievement motivation theories, Pupil D also stated that he desired a level of challenge (**Interviewer:** "It felt good when you came across a word you didn't know how to spell?" **D:** "Yeah" **Interviewer:** "Ok, why did it feel good?" **D:** "Because I wanted a challenge"). Positive affect for Pupil D was linked to him gaining the same score as others in his class. This social comparison may have acted as a motivating factor for him but may also have indicated a wish to avoid failure as Pupil D identified experiencing negative affect due to not achieving the same levels as peers (**Interviewer:** "why would it feel bad not to be learning something?" **D:** "Because I'll be behind all the time"). Achievement theory may indicate that this drive to avoid negative affect would stimulate learning behaviour.

Despite identifying the difficulty level as too high in class assessments, Pupil D identified that the level of challenge during PT sessions was not high enough ("**D:** I know quite a lot of the words we were doing, and it got a bit boring after a

while doing the same words"). In contradiction to this, Pupil D reported positive affect due to his success in PT to be linked to repeating words to learn them (**Interviewer:** "Ok and how did you learn that word?" **D:** "We used it over and over again"). Although he expressed feeling bored, it may be that this discrepancy was manageable for him as he identified that he was making progress and this was a motivating goal for him.

When asked what would have improved PT sessions and produced less negative affect, Pupil D responded that higher levels of challenge were required (**Interviewer:** "What kind of words would have been better?" **D:** "Harder words to spell"). Pupil D identified that PT sessions were 'helpful', increased his spelling confidence, and induced positive affect **(Interviewer:** "Did they *(PT session activities)* make you feel good, bad, in the middle?" **D:** "Good." **Interviewer:** "Can you tell me any more about why". **D:** "Just felt confident about spelling"). Pupil D initiated talking about his probe assessment scores during the interview, and referred to the probe and chart process as the method by which he kept track of progress during the intervention. This indicates that the PT processes of monitoring progress may have been a factor in supporting his understanding of learning changes. Pupil D appeared to make some distinction between different types of achievement, progress in spellings, and wider application of this for tests and school assessment (**Interviewer:**... "so what was helpful about the PT sessions?" **D:** "Helped me to spell and helped me to get higher grades").

5.13 Overall results summary

This section aims to provide a summary of the key findings from the four cases, and summarise the common features across the cases. Yin (2013) indicated that within case study designs, similar findings across case studies can be explored in order to support analysis of general themes. Although not offering a synthesis of results due to the limitations in generalisation of single-case designs, the researcher acknowledges the value of exploring trends within single-case data sets, particularly within the current methodology where case study designs have been replicated (Barlow, et al., 2009).

5.13.1 Research question 1: Does Precision Teaching have a positive effect on control attributions of male pupils towards literacy learning?

All pupils displayed high levels of internal control during the baseline phase. The ratings of Pupil A were observed to slightly decrease during the intervention phase, however all others remained high with the researcher querying the ceiling effects of the measure which may have prevented accurate recording of this element of control. Within powerful others control the effect of PT is not evident during the intervention phase of Pupil A, however a change is present for Pupil B and C with much wider variation in data points within the intervention phase than within the baseline phase. This is not observed to be a significant directional change. Unknown control for Pupils A, B and C were observed to be in the mid-high range of ratings within the baseline phases. Pupil A's ratings decreased in the intervention phase, and Pupil B and C displayed large variation within their unknown control ratings during the intervention phase mirroring the pattern observed for powerful others control. This may indicate that PT impacted pupil perceptions of unknown and powerful others control over their learning.

Although some changes are evident between baseline and intervention phases for pupil perceptions of control as measured by the MMCPC, these are not confidently discussed as significant changes as highlighted by the inter-rater judgements.

5.13.2 Research question 2: Does Precision Teaching have a positive effect on self-efficacy?

Pupil A produced a significantly decreased score between the MALS (Burden,1999) measurement completed pre-baseline and post-intervention. Pupil C also produced a significant decrease change in performance score between the pre and post-test MALS measurement. However these scores remain within the average range of scores which are expected for a child of his age. Pupil B produced a significantly increased change between pre and post-test MALS scores. The pre-test score was below the expected range of self-efficacy scores, with the post-test score within the average range of self-efficacy scores that could be expected according to the standardised scores. Pupil D also indicated a significant increase change between the pre and post test scores for Pupil D's performance in the Myself as a Learner scale. Although Pupil D produced an initial score within the average range of scores indicated by the measure, the higher Time 2 score places him more firmly within this average range. Self-efficacy was therefore observed to increase in two of the four single-case studies. However it should be noted that for Pupil D, this change cannot be confidently attributed to the implementation of PT due to inconsistency during the baseline phase. For two pupils this MALS score decreased between Time 1 and Time 2, indicating that the intervention may have had a negative impact on self-efficacy.

5.13.3 Research question 3: How might Precision Teaching have impacted motivation?

A common theme during the interviews was pupils reporting instability within their learning progress; this equating to improvement changes in their learning as an outcome of PT. Pupils A, B, C and D perceived that they made progress during the PT sessions and referenced the monitoring system (chart) as helping them to keep track of this. Their progress was exemplified in the PT charts for each pupil and pupils linked making progress to positive affect. Some cases

identified a noticeable change in the speed and accuracy of their performance in the skill they had been learning. Pupils also identified increased confidence in using their skills. Identification of improvement through probe assessment and charting may be linked to self-efficacy and achievement motivation as well as adapting internal attributions that success can be gained through their effort in the sessions. Elements of PT were highlighted as external factors which contributed to changes in learning. Specifically the probe timed tests were linked to pupil perceptions of improving literacy skills. Pupils related their progress to sessions and session activities which they described as “fun”, describing the aspect of repetition of skills as being important to their progress.

All pupils described the positive presence of challenge. In particular, Pupil B, C and D noted that the lack of challenge within an activity would produce negative feelings such as boredom. Challenge within the activities used and probe assessments were specified by pupils. Within the interviews, pupils appeared to highlight this element as an extremely positive part of the sessions, producing positive affect and enjoyment. Furthermore, Pupils A and B specifically indicated competition as an extension of the element of challenge. Pupils reported the presence of a level of competition against their previous scores in the PT sessions, in addition to Pupil B describing competition between himself and a fellow pupil.

All pupils described features of the teaching staff as a key element to how much progress they made in their learning. Specifically pupils described their positive feelings about staff who didn’t shout, and how they perceived this to have a positive impact on their learning.

Pupils A and C highlighted elements of not understanding what had led to changes in their learning. This element indicated these pupils did not attribute learning changes to luck or chance, but appeared to be unable to locate the factors creating the change. Although all pupils reported high internal control ratings throughout, there were some differences between pupils in their reported perceptions of controllability over their learning, with some students citing uncontrollable external factors as a cause of their success. Pupils identified the utility of learning their focus skill. Pupil A specifically linked his

perceived utility of the skill as supporting his motivation to apply effort to learning. Pupil A highlighted internal attributions for success outcomes and external attributions for failure outcomes whilst for other pupils this pattern was not as distinct. Although it cannot be conclusive that PT impacted on these attributions, PT may have had an impact on this attribution pattern. This distinction between success and failure outcomes will be reviewed in the discussion.

6 Discussion

6.1 Introduction

This chapter discusses the key findings from the four single cases, and considers the main conclusions with reflection on previous research and theoretical review in the area of motivation. Research design and methods chosen for this research study are reviewed, alongside an examination of the validity and reliability of the results. Concluding sections discuss the implications for applied educational psychologists, and the areas for future research highlighted by this study.

6.2 Key findings

6.2.1 Effect of Precision Teaching on locus of control

The MMCPC measure (Connell, 1985) focuses on three dimensions. These are "the degrees to which children say that they don't know why these outcomes occur (unknown control), that their own attributes bring about these outcomes (internal control), and that other people's attributes bring about these outcomes (powerful others control)" (Connell, 1985, p. 1019). It was hypothesised that for pupils who experience difficulties in their literacy learning, the introduction of PT to promote their literacy skills would have a positive impact on attributions of control these pupils felt towards their literacy outcomes. It was hypothesised that increased motivation would take the form of higher levels of internal attributions over success outcomes, and lower ratings of powerful others and unknown elements of control over general learning. Loci of control has been described extensively in prior research and theory (Weiner, 1985) as having an influence on behaviour and the cognitive intention to act (Azjen, 1991). Locus of control refers to individuals' internal or external attributions for outcomes of behaviour; "the degree to which persons expect that a reinforcement or an outcome of their behaviour is contingent on their own behaviour or personal characteristics versus the degree to which persons expect that the reinforcement or outcome is a function of chance, luck, or fate, is under the control of powerful others, or is simply unpredictable" (Rotter, 1990, p. 489). Individual perception of control is theorised to be a central theme identified

within this theoretical approach to motivation (Kelley, 1967; Schunk, 1981; Weiner, 1985).

All four pupils identified mid to high ratings of their perception of internal control over learning. The limited change between baseline and intervention phase ratings may indicate that for pupils in this study, the introduction of PT did not have an effect on internal attributions of control. However from this data set, the researcher is unable to conclusively label a directional impact of PT on internal attributions due to the apparent ceiling effects of the MMCPC. In addition the statements used within the MMCPC measured internal control attributions for both academic success and failure. This limited the overall analysis of positive and negative patterns of internal attributions. Jacobsen, Lowery and DuCette (1986) described that typically developing children state internal attributions (e.g. ability) as causes of success, but locate causes of failure externally. Children with learning difficulties attribute success and failure (less successful outcomes) to external causes more often than children without learning difficulties (Jacobsen, et al., 1986). Attributions of internal control for success have been reported by students who produce significant levels of effort in their work, and who report higher levels of confidence that they will make academic progress (Banks and Woolfson, 2008). When comparing reported locus of control attributions (locus, control and stability) of young people with learning difficulties with academic progress over two years, Kistner, Osbourne and LeVerrier (1988) found that those who attributed failure to unstable and controllable attributions were more likely to make academic progress. They were also more likely to show independent learning behaviours in the classroom. Causes of failure are rated with higher levels of internal, stable and global attributions for pupils with lower achievement (Försterling & Binser, 2002). High levels of internal control in the current study may indicate pupil perceptions of failure as attributable to internal factors such as their ability.

Limited internal control over success is reviewed as a pre-cursor of learned helplessness, specifically when pupils perceive failure as due to internal causes and perceive it as a global experience (Abramson, et al., 1978). Försterling and Morgenstern (2002) describe that typically attributions serve the self-concept; attributions regarding success are linked to ability much more so than

attributions made on the occasion of failure in an attempt to protect the self from damaging the self-concept. Attributing failure to internal factors has been labelled as a maladaptive attributional style (Abramson, et al., 1978). However maladaptive attributions have been reversed for depressed participants by training participants to use evidence of previous successes and failures to produce "realistic attributions" when attributing causes of future outcomes (Försterling & Morgenstern, 2002). Altering maladaptive attributional styles may therefore promote academic achievement (Kistner, Osbourne and LeVerrier, 1988).

Within the current study, unknown control ratings decreased in one case (Pupil A) and increased in variance during the intervention phases of two cases (Pupil B and C). The decrease in Pupil A's attributions of unknown control may indicate that he was more able to locate the cause of his academic successes or failure (Connell, 1985) following PT implementation. Skinner and Chapman (1984) distinguish between perception of causality (the relationship between causes and outcomes) and perception of control (the potential a person feels they have to affect an outcome). In the discussion surrounding unknown control this distinction becomes increasingly pertinent, as an individual is required to understand cause and effect relationships before they are able to perceive their ability to control an outcome. Furthermore Butler and Orion (1990) reported a strong association between low achievement in school and pupils reporting that they were not aware of the causes of changes to their learning (i.e. unknown control). This study suggested that what distinguished high achievers from low achievers was not the level of control pupils perceived, but that lower achievers were unable to understand why the outcome had occurred. Although a decreasing trend appears to be present during the intervention for Pupil A, wider variation for Pupils B and C may indicate that the introduction of PT affected pupil understanding of why outcomes occurred but did not consistently increase or decrease understanding.

Within powerful others control, the effect of PT is not evident within the intervention phase of Pupil A, however a change is present for Pupil B and C with much wider variation in data points within the intervention phase. However this is not observed to be a significant directional change. Decreasing external

control factors and increasing internal control has been identified to have positive impacts on learning; research indicates that increasing the level of autonomy within extrinsic motivation programmes (i.e. programmes which attribute outcomes to participant factors such as effort) has promoted pupils to be more engaged with learning (Patrick, Skinner, & Connell, 1993), with increasing autonomy leading to higher attainment (Miserandino, 1996) and increased teacher ratings of pupil learning behaviours (Harris & Rosenthal, 1985). When reviewing research previously analysed as indicating internal or external attributions of control, Rotter (1990) found that expectancies of future success were higher when individuals received re-enforcement based on their competence rather than chance or experimenter control (Blackman, 1962). This suggests that a decrease in powerful others control may be beneficial to learning alongside an increase in internal attributions for success and increased feelings of self-efficacy over successful outcomes and feelings of self-competence. The variation of ratings for powerful others control increased for Pupils B and C could suggest a changing perception of the impact of powerful others control over learning for these pupils. However these pupils' internal control ratings also remained high, potentially suggesting limited inter-play between these two factors, or reflective of ceiling effects in the measurement of control ratings.

6.2.2 Effect of Precision Teaching on self-efficacy

The researcher hypothesised that participants who experienced regular learning difficulties and indicated low motivation to engage in learning would display low learning self-efficacy. It was further hypothesised that following implementation of PT, pupil self-efficacy would increase. An increase in self-efficacy within research examining PT has been previously described (Downer, 2007; Roberts and Norwich, 2010). Within the pre and post measurement of self-efficacy (MALS) (Burden 1999), self-efficacy ratings increased for two of the participants in this study (Pupils B and D). This indicates that their self-efficacy, as defined by pupil perception of themselves as a learner and problem solver (Burden, 1999), and confidence that they can successfully perform academic tasks (Bong & Skaalvik, 2003) increased following the intervention period. However, caution

should be taken when analysing the self-efficacy results of Pupil D due to the inconsistency in his baseline phase.

Bandura (1999) states “failure produces high motivation and low despondent mood when people believe they have the efficacy to fulfil difficult performance standards” (Bandura, Pastorelli, Barbaranelli, & Caprara, 1999, p. 259). Burden (1998) describes significant concurrent validity (p=0.001) between the MMCPC scale (Connell, 1985) and the MALS measure (Burden, 1999). In this way, self-efficacy beliefs could be characterised by intrinsic motivation (Harter, 1978) and internal attributions as located within the attributional model of locus of causality (Weiner, 1985). This concurrent validity may also indicate that lower unknown attributions are associated with higher reported self-efficacy (Burden, 1999). Pupils B and D displayed lower ratings of powerful others control and unknown control over learning, in comparison to Pupil A and C who both produced high ratings for their unknown and powerful others control attributions. Although internal control was rated highly for all participants, a tentative analysis of these results may suggest that pupils who attribute less control over learning to external causes, and who are able to locate causal attributions for their learning, specifically within internal attributions, may experience more positive academic self-concepts. This would be consistent with research relating to the positive impact of internal attributions of control on self-concept and mood (Försterling and Binser, 2002).

The increase in self-concept observed in the scores of Pupil B and D may also reflect the impact of pupils receiving increased evidence of achievement and mastery within the intervention. Self-efficacy theory hypothesises that promoting mastery experiences increases self-efficacy (Bandura, 1997). Rhodewalt and Vohs (2005) state that competence is a key factor in self-worth, leading to the individual being invested in ensuring their competence is upheld through engaging fully in the task. Research indicates that interventions to increase task fluency are correlated with increased self-competence beliefs (Quirk, et al., 2009) thereby suggesting that that increased self-efficacy for Pupil B may have been affected by increased fluency as taught through PT.

Dweck and Molden (2005) indicate that individuals' self-theories about the causes of their competence feed into their self-worth and motivation. This is highlighted to have important practical application in schools, to engage achievement motivation and subsequent learning through promoting individual competence in the classroom (Raven, 1989). Increased competence and subsequent mastery in a subject have been found to promote higher levels of cognitive engagement with a task (Meece, et al., 1988), and is predictive of positive learning behaviour such as time spent on reading activities (Baker and Wigfield, 1999) in addition to adopting in-depth strategic approaches to learning over a long-term period (Prat-Sala & Redford, 2010). Mastery is also indicated to promote positive affective outcomes when achieving learning goals (Ames, 1992). Research indicates that increased academic self-concept and self-efficacy increase positive affect (Bong & Skaalvik, 2003). Conversely, negative self-efficacy beliefs are linked to feelings of depression (Bandura et al. 1999).

Decreased academic self-concept scores were observed for Pupils A and C. In observing the PT charts, both pupils made progress in their assigned literacy skill and therefore competence and self-efficacy would be expected to increase (Quirk, et al., 2009). Wider literature on academic self-concept indicates that self-concept may be specific to particular domains (Marsh, 1990), and appears to be context specific (Marsh & Shavelson, 1985), therefore a general measure of academic self-concept such as the MALS may reflect a broad self-concept which may have been impacted by variables such as limited progress in other subject areas. It may also be possible that PT had a negative impact on self-efficacy through introducing themes of low self-competence or self-efficacy for pupils. This would require further investigation and is not indicated in the affective responses of pupils to the intervention, or in the progress made during the programme. Marsh and Martin (2011) report that self-efficacy promotes and pre-empts achievement, with achievement then promoting further self-efficacy and positive self-concept. Although the PT charts record improvement in accuracy and fluency for pupils, it may be that the intervention was not in place for a sufficient time period to improve pupils' beliefs and confidence about their increased ability to maintain and generalise their success as described in the instructional hierarchy (Haring et al., 1978).

6.2.3 Potential mechanisms of change

In the current study, a realist overarching framework was adopted in order to explore the effect of PT on motivation. Realist synthesis adopts the assumption that evaluation of an intervention's success is not based purely on outcomes. Rather it focuses on the context and learner characteristics which are required to trigger the mechanisms which produce intervention success. Realism advocates that "it is not programmes that work but the resources they offer to enable their subjects to make them work" (Pawson, 2002, p. 342). The following discussion incorporates elements which were identified through thematic analysis of pupil interview responses as factors which may have influenced pupil motivation towards literacy. These are discussed as potential mechanisms of how PT may have influenced motivation.

Within the thematic analysis, a common theme highlighted by participants was the presence of challenge, both within activities and assessment elements of PT. Specifically pupils B, C and D described negative outcomes such as boredom relating to the challenge level. Pupil C stated "If it were easy it would have been boring". Pupil D also identified his perception of the positive element of challenge,

Interviewer: "It felt good when you came across a word you didn't know how to spell?"
D: "Yeah..."
Interviewer: "Ok, why did it feel good?"
D: "Because I wanted a challenge".

Provision of adequate challenge is incorporated within the PT guidance (Raybould, 2002) and advocates that aim rates are used to determine this for each pupil. Achievement motivation suggests that most individuals prefer and are motivated by tasks which incorporate some level of challenge (Weiner, 1992). McClelland et al (1953) suggested that achievement motivation can be enhanced by introducing challenging tasks which an individual is intrinsically motivated to overcome, with low challenge level losing the learner's attention, whilst high level challenge may induce negative affect. Competition challenge

was also highlighted by participants to be involved in creating positive affect during the PT sessions,

Interviewer: “What did that make you feel like?”
Pupil B: “Erm happy...like we [Pupils A, B and C] were having this little contest thing.”
Interviewer: “having a contest?”
B: “Yeah seeing who could get the most.”

The following mechanistic link is therefore proposed.

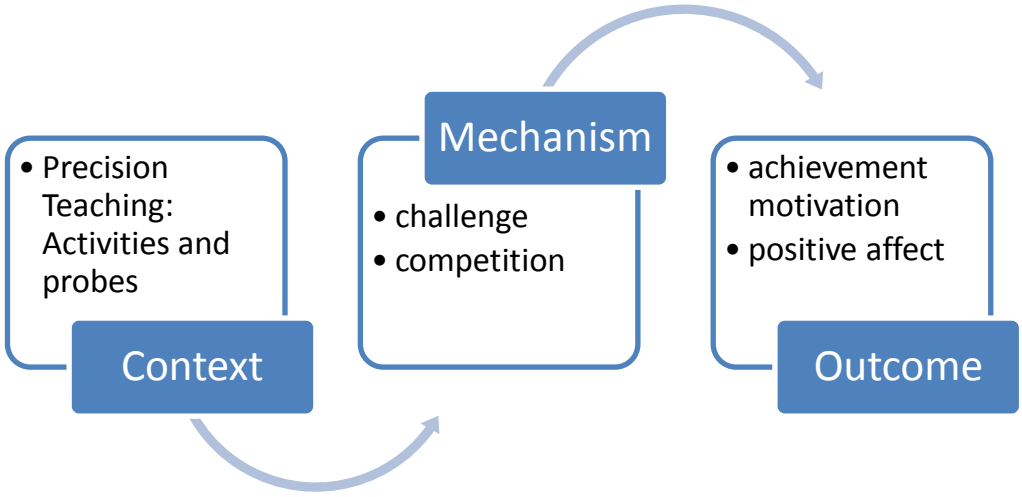

Figure 6.1 Challenge and competition as potential mechanisms of motivation change

Competition has been indicated to promote reading attainment in male pupils through the provision of reading challenges or competitions (Clark & Burke, 2012). Challenge has also been linked to increased observed learning behaviour; Baker and Wigfield (1999) indicated that challenge was significantly positively correlated with children’s reports of time spent on reading. However there is debate regarding the positive impact of competition on motivation. Research suggests that competition can be linked with performance goals and this produces negative self-evaluations following failure (Lam, Yim, Law, & Cheung, 2004). This has led to calls for the focus of feedback about learning outcomes to be on mastery and effort (Lumsden, 1994). However attribution theorists describe the negative impact of attributing failure to internal factors

such as effort (Abramson, et al., 1978; Weiner, 2005). This therefore suggests that further exploration is required to identify how competition can be used positively to promote achievement, whilst also not damaging self-concept and motivation attributions.

During the interviews, pupils highlighted that charting and staff encouragement provided feedback about progress during the intervention. Through charting, PT provides a measure of proficiency by examining both what a pupil is able to do and how quickly they are able to do it (Lindsley, 1992; Raybould & Solity, 1982a). Therefore learners are increasingly aware of the increased competence within their learning. Competence is linked to increased intrinsic motivation (Harter, 1981; Harter & Connell, 1984), and the competency beliefs of learners are indicated to mediate changes to the value placed on activities (Durik, et al., 2006) which in turn impacts on motivation to engage in activities. Participants described the chart as a visual indicator of changes in their learning, and linked this with positive affect.

Interviewer: "what did it feel like when you were doing the sessions and you were doing you handwriting and you saw at the end that your green line was going up?"
C: "Well, it makes me feel good."
Interviewer: "Mmm, why did it make you feel good?"
C: "Because it showed that my handwriting's getting better".

The following diagram highlights the hypothesised mechanism and the potential motivational outcomes it could impact.

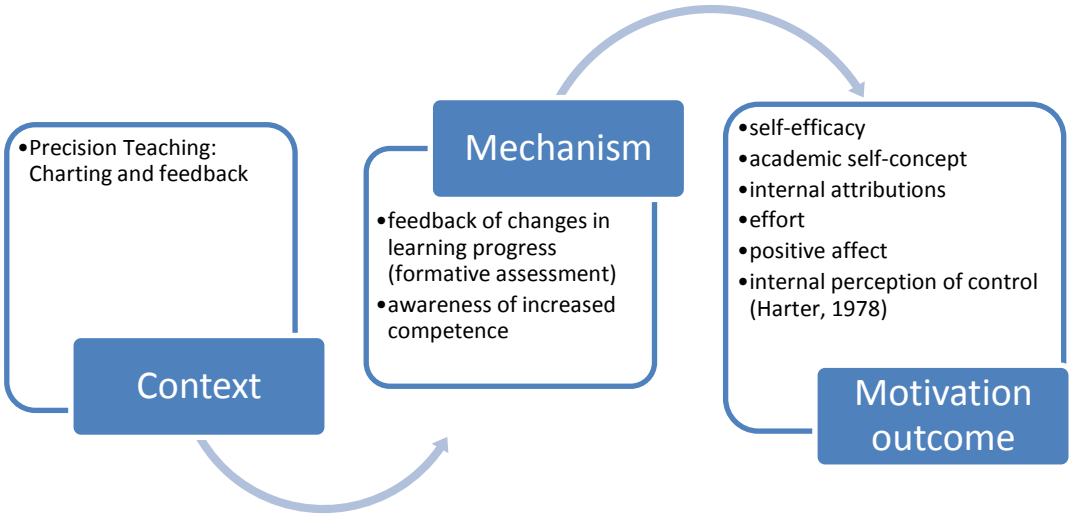

Figure 6.2 Feedback of progress as a potential mechanism for motivation change

PT is argued to utilise formative assessment through these routine timed assessments and underpinning instructional hierarchy framework. Formative assessment is defined by its methods of adapting teaching instruction and assessment to support each pupil's specific learning needs and understanding (Black, Harrison, Lee, Marshall, & Wiliam, 2004; Torrance & Pryor, 2001). Formative assessment has been reported to have a positive impact on pupil self-perceptions of themselves as learners (Miller & Lavin, 2007), with summative assessment negatively impacting self-efficacy and learning self-esteem (Harlen & Crick, 2002).

Realistic feedback regarding learners' ability to complete tasks successfully appears to produce more realistic attributions about learning changes, and more effort directed to tasks where success has been evidenced (Försterling & Morgenstern, 2002). Furthermore Butler (1987) reported that interest in tasks, attribution of effort and achievement were linked to students receiving specific comment on their performance. Feedback which refers specifically to the individual (formative assessment) promotes mastery achievement, where normative feedback links to performance related goals (extrinsic motivation) (Pekrun, Cusack, Murayama, Elliot, & Thomas, 2014). Process-oriented

comments had a greater effect on changes in maths achievement and student levels of interest than feedback which highlighted grades (Harks, Rakoczy, Hattie, Besser, & Klieme, 2013). Formative feedback as provided by the PT charts and staff feedback may therefore have impacted similar outcomes for the current study's participants.

In the thematic analysis, pupils B and D noted the difference between focussing on literacy to achieve good grades, and learning literacy skills for intrinsic value of the subject. This may correspond to the distinction between subjective and task-values of literacy (Wigfield & Guthrie, 1997), with students in this study linking literacy skills to being intrinsically valuable and motivating due to their utility, where literacy skills learned for tests were not motivating:

B: "In these sheets (*pointing to PT words and probe sheets in front of him)* they're just like words and they're like, they don't really like matter…well they do for your learning and that but like…[pause]… They <u>do</u> matter but they don't, they don't go into like our thingys for our levels and they're just like there to help me and that…"

It may be that for these pupils, PT tapped into participants' intrinsic value of literacy skills.

Failure in learning was also highlighted within the pupil interviews. Those who have experienced high levels of failure are more likely to interpret this failure as having internal causal attributions rather than typically external attributions (Jacobsen et al. 1986). Although the current study's participants made some internal attributions for their progress, participants also attributed success to external factors. Participants who have experienced higher incidences of failure appear to make less realistic causal attributions in a similar trend to those who are depressed (Fosterling and Binder, 2002a).These maladaptive attributional styles are linked with students perceiving that failure is inevitable and engaging in limited persistence in tasks (Nunez, Gonzalez-Pienda, Gonzalez-Pumariega, Roces, Alvarez, Gonzalez, 2005). Those who produce maladaptive attributions are suggested to engage in a cycle of decreased motivation and achievement in learning as a result of maladaptive thinking styles (Chodkiewicz & Boyle, 2014) as exemplified in the cycle below

Figure 6.3 Cyclical interaction between attribution style and academic achievement as taken from Chodkiewicz & Boyle, 2014, p.81.

Consideration of the motivating factors for each individual and engaging in promoting adaptive thinking styles to support positive attributions may therefore be of benefit to supporting motivation (Casserly, 2013). However it further highlights the difficulty in analysing and identifying the cause and effect relationship within motivation (Becker et al. 2010). It may therefore be important to consider combining programmes which support progress with those which support adaptive attribution styles to promote motivation alongside learning.

6.3 Evaluation of measures

Within this research study, the Multidimensional Model of Children's Perceptions of Control (MMCPC) (Connell, 1985) was used to evaluate changes in the internal, external and unknown attributions of pupils. Research indicates that self-concepts are domain specific rather than generalised (Marsh, 1990; Song & Hattie, 1985) which this measure acknowledges. Factor analysis raised some concern that the MMCPC when used in total form cannot reliably discriminate control across the different domains it sets out to measure but does distinguish between control elements within domains (Marsh & Gouvernet, 1989). The MMCPC scale has previously been used to examine pupil perceptions of the classroom climate and loci of control over learning (R. M. Ryan & Grolnick, 1986), the effect of child perception of parent involvement on loci of control over learning (Grolnick, Ryan, & Deci, 1991), the effect of coach feedback on pupils' physical perceptions of themselves (Horn, 1985) and to support understanding of pupil locus of control in a number of other contexts

within research studies (Grolnick & Slowiaczek, 1994; Morton, 1997; Mynard, Joseph, & Alexander, 2000). It therefore provided an established measurement tool.

As discussed in Section 4.8, internal consistency of the cognitive scale items was indicated. The cognitive scale was chosen for use as this was relevant to the research question. Limiting the length of the repeated measure met the ethical principles held by the researcher to cause no harm or stress to participants despite repetition. This measure was also easily accessible to the researcher within the time frame available. On reflection, the use of a measure which further specified control elements (i.e. effort and ability) such as The Student Perceptions of Control Questionnaire (Wellborn, Connell, & Skinner, 1989) may have supported more definitive conclusions. Ceiling and floor effects were evident for some participants during MMCPC measurement. This may indicate the measure may not have been appropriate to discriminate responses particularly in areas of internal and unknown control.

MALS

The Myself as a Learner Scale (MALS) (Burden, 1998) has been used to explore academic self-concept in a wide array of research studies including reviewing the impact of teacher praise (Chalk & Bizo, 2004), transition to secondary school (Norgate, Osborne, & Warhurst, 2013) and dyslexia (Burden & Burdett, 2005). It has been demonstrated to have strong internal consistency (alpha coefficient = 0.85). In addition the MALS measure has been indicated to have strong concurrent validity with the MMCPC (Connell, 1985), providing strength to the coherence of results gained using both of these measures in the current study. This was a key aspect in choosing these measures for the current study.

Child perceptions of motivation as measured by the MMCPC were the primary source of data within the single-case design. Although these perceptions were triangulated through use of a correlated pre and post measure and qualitative interview methods, and matched prior theory on the importance of individual perceptions (Kelley, 1980), the behavioural impact of any changes in motivation were not measured. Previous studies have used observations and staff ratings

of pupil behaviour (Gottfried, 1990) to provide an additional indication of motivational change (Becker, et al., 2010; Dai & Wang, 2007). Despite initial development by the researcher of a staff perception of motivational change measure, this was eliminated due to limitations of the high subjectivity of staff ratings. Motivating factors and attributions of success and failure are highly individual (Kelley & Michela, 1980). It may have been of further interest to compare any changes in attribution and motivation with observed changes in specific behaviour to test further theoretical links within this data set. However research studies on factors affecting motivation have widely used participant perceptions as the primary measure (Patrick, et al., 1993) as is the case in this research study.

6.4 Validity

In order to have confidence in the conclusions, consideration of validity within the methodology, data gathering and analysis techniques are essential (Cohen, et al., 2011). Horner, Carr, Halle, McGee, Odom and Wolery (2005) specify that within single-case designs, due to conclusions of effect being dependent on phase repetition, and generalisation being reliant on specific replication, detailed descriptions of pupils, contexts and independent variables are essential (McCormick, 1995). This level of description has been prioritised throughout this study.

Kratochwill et al (2010) cites the following factors as threats to validity particularly within single-case designs; these are discussed in relation to the current study.

Ambiguous temporal precedence

This refers to the time an independent variable is introduced so as to conclude the effect of one variable on another. Within the current study, staff received the PT training at multiple points during the baseline phase, PT was not introduced until the intervention phase. Although staff were explicitly asked to continue their original teaching methods until the intervention phase, the principles taught within the PT training could have impacted on teaching within the baseline phase. This variable is acknowledged here, however the real-world context required the researcher to introduce the PT intervention to staff before the

intervention phase. This was completed with explanation of the overall research design so as to eliminate any unintentional cross-over effects.

Selection

Selection of participants was controlled through using initial inclusion criteria specified in Section 4.3.4. On reflection, more defined criteria may have improved selection. The researcher acknowledges this threat to validity of the current study, particularly within a multiple baseline design. Selection also refers to the introduction of the intervention phase for different participants within a multiple baseline design (Kratochwill, et al., 2010). Introduction of the intervention within this research study was randomised by school rather than individual participant need. This random introduction may provide additional strength to the design as introducing the intervention to pupils with most need first may have introduced a false improvement effect impacting on intervention effects.

History

The researcher diligently sought information on each pupil during the project to explore any confounding variables which may have had an impact on motivation outside of the introduction of PT. For six of the ten participants, PT was not completed with the consistency required to be confident that PT impacted motivation change outside of any confounding history variables. Therefore these participants were excluded from the in depth data analysis (see Appendix 5.5). Despite using an AB design which does not protect for the effects of history (Kratochwill, et al., 2010), the multiple baseline provides some strength to the methodology through multiple introductions of the intervention over time (Barlow, Nick & Hersen, 2009).

Maturation

Studies must demonstrate the effect of an intervention at three different time points with Kratochwill et al. (2010) describing that a multiple baseline design meets this criteria if they also have at least three baseline conditions. In this way the threat of maturation is weakened due to the reduced likelihood that

maturation effects have affected all time points evenly. Within any SCED design, repeated measurement ensures a protective factor against maturation.

Statistical regression

Repeated measurement of loci of control throughout the study in addition to the pre and post-intervention measures provided the researcher with a method of analysing any regression to the mean. In addition the analysis of variation, trend and level within data sets introduced further protection from statistical regression being mistaken for an intervention effect.

Attrition

Kratochwill et al (2010) state that participant drop-out can have an invalidating effect on data analysis due to limited data points. Within the current study Pupils E and J demonstrated limited data points through absence and the number of received PT sessions was used as a comprehensive exclusion criteria by the researcher (as described in Section 5.5) to establish single cases whereby the effects of PT could be more reliably inferred (Kessissoglou & Farrell, 1995; Raybould & Solity, 1982b; Roberts & Norwich, 2010).

Testing

The MMCPC measure was adapted to meet the concentration span of the participants as detailed in section 4.6. Repetition of the measure is acknowledged as a potential threat to its validity. The researcher addressed this by tailoring the measure to pose randomised items in order to prevent practice effects and produced an interactive mode of response. This response mode was piloted. The researcher acknowledges that increased familiarity with statements through repetition may have created decreasing engagement despite the efforts of the researcher. Anecdotally participants appeared to enjoy completing the repeated measure. The researcher therefore has reason to believe that the repeated exposure did not negatively impact on engagement and therefore did not impact on the validity of the responses given.

Instrumentation

The conditions under which the MMCPC was delivered during both baseline and intervention phases remained consistent throughout. Consistent scripts were used by the researcher to administer both the MMCPC and MALS measures (see Appendix 6 and 7) in an effort to increase the validity of data gathering. The measures had pre-defined statements, and were chosen with no input from the researcher, therefore limiting any effect of researcher bias. Both measures had been piloted with pupils of the age included in this study to ensure participants would be able to understand the statements and response choices (see Section 4.7) which strengthened the mode validity.

6.5 Reflection on design

Strengths

In this research study, using a single case experimental design (SCED) to analyse the effect of the independent variable supported a robust framework to analyse the effect of PT on locus of control, with measures taken at consistent intervals to allow for close analysis of changes over time. In addition this design allowed the researcher to explore the individual responses of participants rather than amalgamating them within a group design. Use of a pre and post measure with concurrent validity to the MMCPC added strength to conclusions as it supplemented the repeated measures taken within the SCED. In addition, use of the Reliable Change Index (RCI) to analyse changes between pre and post intervention performance strengthened the analysis of any significant changes and increased the validity of the conclusions made.

Visual analysis for each case was provided with three inter-rater judgements, which guarded against criticism of the subjective nature of visual analysis of single-case data. In addition these inter-rater judgements were statistically analysed to assess the level of correlation between them. The use of numerical data to analyse SCED data values provided information to supplement visual analysis. This strengthened the method of data analysis in this research study in accordance with recent research developments and recommendations as outlined in Section 5.3.

Use of qualitative data gathering methods following the PT intervention allowed for the researcher to explore the values and motivational factors for each pupil, and attempted to draw out and analyse the contribution these may have made. Inter-rater judgements regarding the allocation of interview statements and codes to overall themes also promoted the reliability of the thematic analysis. The interviews used a structured framework and qualitative methods to avoid invalidating data through factors such as leading questions, whilst supporting participants to provide as much information as possible through integrating advice on probes, and interview techniques specifically for use with children (Berg, 1995; Lodico, Spaulding, & Voegtle, 2006; Robson, 2011). Weekly interaction with staff and pupils provided an opportunity for the researcher to support treatment fidelity and explore the potential factors which may influence history or maturation conclusions when analysing the data.

Challenges

Within research it is also crucial to consider the methodological weaknesses in order to assess limitations to conclusions. The following factors have been identified within the current research study.

The researcher liaised with teaching staff on a number of occasions to promote understanding of the need for regular PT sessions, with this explicitly stated within the training. Although this liaison increased the number of PT sessions completed, low average sessions over the intervention phase occurred within two of the three schools participating in this project as described in Section 5.5.

Due to the timings of the school term, a period of holiday took place either within the baseline phase or just prior to the start of the intervention phase for participants. This led to a limited number of data points for some participants, alongside large gaps in the data sets of some participants due to holiday periods and absences. Confidence in the effect of the intervention could have been compromised due to these missing data points. This was considered by the researcher to represent uncontrollable factors of working within a real-world research context (Robson, 2011), and flexibility was required from the researcher to comply with school term time scales. However in future research,

the researcher acknowledges closer definition of timelines during term-time is imperative for rigorous methodologies to be applied to real world settings.

The baseline for participants was limited to between three to five data points. Whilst the recommended minimum number of three data points was met (Kratochwill, et al., 2010), the researcher acknowledges the strength of conclusions would have been enhanced by longer baselines, and improved stability before the intervention is introduced. Ethical considerations were part of this decision, as delaying the intervention would have resulted in delaying the implementation of an evidence based intervention to pupils who were experiencing difficulties in their literacy skills at a key point in their academic career. Multiple baseline analysis was hampered by three data point baseline phases despite the extended length of baseline period for some participants. The longer time-frame gave an indication of the consistency of a stable baseline pattern. However longer baselines and more data points would have been preferable to determine a stronger stability effect and enabling stronger conclusions about any effect of the intervention phases. In addition, although all pupils involved in the research study were taking part in 1-1 literacy sessions prior to the start of the research project, some students were not receiving this as regularly as was required for PT implementation in the intervention phase. Therefore to endorse equivalence between baseline and intervention phases, the number of times some pupils received teaching sessions in the baseline phase were put into place more consistently than prior to the research project taking place. This could have impacted on pupil MMCPC ratings in the baseline phase. The researcher acknowledges this as a compromise to the conclusions, but that this compromise was necessary to support equivalence in the consistency of sessions provided across the baseline and intervention phases.

A comprehensive test of pupil literacy skills was not completed pre and post intervention. Considering the theoretical and evidence based link between competence and elements of motivation, it may have been of interest to have incorporated an element of pre and post assessment of literacy skill. However a measurement of literacy skills was not considered to be directly applicable to the research questions posed in this study, with pupil attributions the principle focus. The opportunity to analyse the longer term effects of PT on motivation

was not available within the present study. Considering that motivation elements such as self-efficacy, changes in competence beliefs and locus of control over learning may change over longer periods of time (Bong & Skaalvik, 2003), a delayed post-test measure may have supplemented results. Using Teaching Assistants to deliver the intervention may have contributed to limits in the fidelity of PT implementation. However comprehensive training was completed with all staff, alongside weekly visits to complete the repeated measures at each school during which staff were aware of the availability of the researcher to support them with any queries. In addition fidelity checks were completed with each staff-pupil dyad.

6.6 Conclusions

6.6.1 Original contribution of the current study

A review of current literature indicates wide reaching study of factors which impact motivation such as self-efficacy (Bong & Skaalvik, 2003), loci of control (Feather, 1967; Flowers, Milner, & Moore, 2003) and attributions (Weiner, 2005). PT is also indicated to be a formative intervention, providing feedback on areas of attainment requiring improvement (Irons, 2008) within time-bound goals (Miller & Lavin, 2007). Moreover, the close monitoring of progress is described to be a key method by which PT promotes progress (Raybould & Solity, 1988b). Anecdotal indications from previous research suggests that PT has a positive impact on the self-efficacy of young people who have difficulties acquiring and retaining learning skills (Roberts & Norwich, 2010). This study is the first to focus on how PT may impact motivation, and sought to contribute a detailed understanding of the impact of PT on aspects of motivation specifically within a population who are more vulnerable to lower motivation towards literacy learning. The SCED methodology provides a close account of changes to motivation when PT was implemented, and is the first to highlight this factor through focus on individual cases. The current study is also the first to provide qualitative data to explore the potential mechanisms of motivational change as a result of PT.

Furthermore, this research has combined reviewing loci of control alongside self-efficacy in a unique contribution to the understanding of the impact of PT. Exploration of motivation and self-efficacy within a population with low self-academic perceptions and limited literacy motivation is suggested to provide a unique area of research, resulting in the current study focussing on male pupils in the later primary school years when motivation particularly towards literacy learning is evidenced to decrease (Clark & Burke, 2012; Eccles, et al., 1993). Despite the limitations present, and challenges of real world research, this study suggests that PT may have an effect on motivation through supporting progress, promoting pupil feelings of competence through its monitoring and assessment techniques, and introducing elements of challenge which may have a positive effect on pupils' motivation to engage. This study also suggests that PT could have had a positive impact on unknown causal attributions for the participants in this study as discussed in Section 6.2.1. The researcher acknowledges that any trends identified in this paper are based on four single cases, and therefore require further research to increase their validity and generalisability.

6.6.2 Questions for future research

The mechanisms proposed in this paper will require further research due to the limited number of participants these conclusions are based on. Students who take part in PT sessions typically have difficulties with learning which have been linked to maladaptive attributions and extrinsic rather than intrinsic motivation. Exploration of how PT impacts on a specific maladaptive attribution pattern such as stable, uncontrollable and internal causal attributions (Weiner, 1972) may provide a method through which systematic measurement of the impact of PT on the broader concept of motivation can be made. It may also be of interest to complete further longitudinal study of PT to explore the longer term effects of this intervention on motivation. Exploring motivation during the intervention and over the following year after the intervention has ended shows consideration to the typical long-term trajectory of areas of motivation and self-concept. Longitudinal data may also highlight differences between motivation at the beginning and end of the intervention. In addition, to further explore the specific

impact of PT on motivation, a comparative methodology could be used to compare motivational outcomes for pupils receiving PT, and those receiving other evidence based interventions for literacy. This would further highlight the specific elements included in PT which may impact on motivation and attributions.

Within the results of this study, Pupil A indicated similar changes in the internal and unknown rating scales across the intervention phase. Unknown control as measured by the MMCPC has been described to represent non-understanding of how an outcome has occurred (Marsh & Gouvernet, 1989).Therefore investigation of pupil perceptions of causality and perceptions of control (Skinner & Chapman, 1984) as a result of PT may be a fruitful area for further research.

This research paper focussed on the outcomes of male pupils as they have increased vulnerability of under-achievement in literacy, and decreased motivation to engage in literacy activities. However comments on how males respond to PT are limited due to the lack of female participants in the current study. It may therefore be of further interest to complete comparative research on the mechanisms of change and whether these are affected by gender. It may be of future importance to researchers to explore the application of competition and challenge for participants, to review any difference in their impact on motivation as mediated by gender. It may also be of interest to explore how competition and challenge contribute to learning self-concept and specifically how students can be supported if they perceive themselves to achieve less than their peers.

6.6.3 Implications for future Educational Psychology practice

Maintaining fidelity to the PT approach in applied settings can present a challenge; this has led previous research to indicate the need for support for staff in implementing the intervention whilst allowing flexibility in implementation to reflect pupil mood, disposition and achievement during the previous session (Roberts and Norwich, 2010). This was indicated in the current study, with staff specifically around Pupil D highlighting the need for sensitivity in the activities

chosen for him which reflected his level of confidence during each session. Therefore staff may require reflective practitioners, such as EPs, with whom to discuss the application of the PT guidance. Although the guidelines are readily available, putting these elements into practice is not a simple mechanism and requires review of specific pupil needs. The EP is well placed to provide this support, and to draw out themes of pupil self-concepts which may be impacting on effectiveness and fidelity of PT. The contribution of EPs to promoting evidence based practice to support the needs of young people is paramount to the role. Using research methods within practice is described as a key contribution of EPs to the evidence base, with this specifically described in the potential for EPs to apply single-case designs to typical casework (Horner, et al., 2005).

Motivation is a complex mechanism, but is argued to be an important consideration within the learning environment (Raven, 1989). Research reviewed in this paper describes attribution beliefs to have positive and negative results on behaviour depending on the perceived locus and stability of the cause as perceived by the young person. EPs are well placed to review pupil behaviour in light of factors of motivation, which may be impacting on this observed behaviour. Consideration of facets of academic motivation and the potential impact on affect and self-concept in school may be extremely useful for EPs to consider with staff, particularly when putting educational interventions into place. In addition the mechanisms which have been highlighted in this study to have a potential impact on motivation may also be applied by EPs across wider casework. Realism provides a framework by which mechanisms are the pivotal factors through which interventions are successful. EPs are therefore in a principle position to review how these mechanisms work within a broader spectrum of interventions for young people, and in so doing, build on a realistic synthesis of evidence based practice (Pawson, 2002).

Ames (1991) remarks that when considering motivation, this may not be fully measured by changes in behaviour such as changes in progress, or spending more time on certain tasks, reasoning that qualitative changes are equally important when focussing on motivation. These may be factors such as pupil self-concept, confidence to approach tasks and decreased anxiety when faced

with a challenging activity, which are not as readily measurable as external behaviours, but are equally important to underlying changes in pupils' experiences of school. The researcher would argue that the educational psychologist is well placed to advocate for the less perceptible aspects of pupil experience of the school environment.

6.6.4 Researcher reflections

Throughout the course of this project, the researcher has reflected on the challenges of completing research in a real world context, whilst endeavouring to apply rigorous research methods with the purpose of gaining useful results. The challenges of implementing PT in a school setting included ensuring staff had sufficient time in their schedule to prepare and complete the sessions, and ensuring fidelity to the intervention. The researcher acknowledges that on reflection, successful staff timetabling occurred only in the school where the initial staff training included the senior management team. The researcher would suggest that this may have been a key factor in supporting consistent PT implementation. This factor generated the decision to remove six pupils from in depth data analysis, which was done to support confidence in the conclusions through methodological rigour. This decision required a high level of flexibility for the researcher and research design but did allow deeper analysis of participants' attributions which promoted the utility of conclusions. Fidelity of the intervention was supported by the presence of the researcher each week. On reflection, staff may have benefitted from prior experience of implementing PT in order to apply it with higher fidelity in the current study.

The aim of the researcher to apply rigour to the methodology also introduced the challenge of applying a multiple baseline methodology in an applied research setting. The school holidays alongside the time restrictions of the researcher meant that applying a series of baselines with more than three data points was a significant challenge. Extending or repeating the single cases was considered by the researcher; however changes in the school status and organisational structures prevented this. Time constraints in organising a series of single-case designs to start at staggered time points across three settings

also produced logistical challenges which compromised the length of the baseline phases gained. On reflection these challenges might have been reduced by using cases in a single school, however within applied research, it would be extremely difficult to gain enough participants for a multiple baseline study within one setting. The limitations of the present study are considered by the researcher as part of the artefacts of applied 'real world' research (Robson, 2011). The pragmatic mixed methods approach adopted by the researcher meant that a flexible response was created to work within these constraints. Whilst acknowledging the limitations that this creates for the present study, the researcher would argue that the conclusions are of value to applied practice and the wider understanding of the impact of PT in real world school settings, and have developed the researcher's experience as an applied research practitioner.

6.6.5 Concluding remarks

Promoting literacy attainment remains a priority in UK legislation (DfE, 2012a) with strong links between poor literacy achievement and negative future outcomes (Gross, et al., 2006). It is widely recognised that differences in literacy attainment on leaving full time education have a significant impact on economic outcomes, specifically linked to an individual's earnings and likelihood of employment (Raudenbush & Kasim, 1998). Reading and writing achievement at the end of Key Stage 2 is reported to be consistently below average for male pupils as compared to female pupils (2005), with this literacy gap not lessening over time (Mullis, et al., 2011). Boys are also less likely to identify themselves as readers than girls (Jones, et al., 2003). This has led to calls for a review of the modes of accessing literacy, and attitudes towards literacy which may be factors in this apparent discrepancy (Clark & Burke, 2012). Therefore it appears important not only to support literacy attainment, but corresponding attitudes and motivation towards learning which were the focal points of this study.

PT is an evidence based intervention which has been shown to promote fluency in literacy skills in a range of studies (Binder & Watkins, 1990; Douglass & Mangold, 1975; Roberts & Norwich, 2010). Within the current study, pupils

made consistent progress as evidenced in their monitoring charts (see Appendix 8.29, 8.30, 8.31 and 8.32), and perceived that they had made fluency and accuracy progress when interviewed. This perceived change in competence may have had an impact on academic self-concept, confidence and motivation towards learning. Research describes the positive impact of motivation on learning (Baker & Wigfield, 1999; Durik, et al., 2006), and the impact of mastery on future motivation. Rhodewalt and Vohs (2005) state that competence is a key factor in self-worth, leading the individual to be invested in ensuring their competence is upheld through engaging fully in the task. The robust evidence base for the success of PT in supporting learning progress (Binder & Watkins, 1990; Cavallini, et al., 2010; Oskar-Groen, 2010) and the links made between increased success and aspects of motivation, would therefore suggest that PT could promote motivation through achievement and increased competence (Quirk, et al., 2009). The current study describes the potential impact PT may have had on changing pupil's unknown control attributions and how pupils attributed learning outcomes to the control of powerful others. However, the direction of this change is not definitive and therefore further research would be required to explore this effect.

The indication within the systematic literature search identified a lack of research which reviewed the impact of PT on populations with limited motivation towards learning. The current study acknowledged the multi-faceted nature of motivation and explored the potential mechanisms of competition, challenge feedback and progress through which PT may have impacted motivation. However it is acknowledged that these mechanisms require further exploration through research to identify and understand the differing contexts in which these mechanisms operate. The researcher would advocate for the utility of exploring these mechanisms of change further across participant characteristics and contexts through a realistic evaluation review of literature (Pawson, 2002), as this may provide a route to understand how the mechanisms within PT promote motivation toward literacy across different contexts and pupils.

Within motivational research, it is challenging to confidently predict how motivation impacts on successful learning experiences. Within the current study, understanding of both the affective and behavioural outcomes of

motivation have been hypothesised through cognitive theories such as attribution theory which acknowledge perceptions of success and failure outcomes as affecting motivated feelings and behaviour (Kelley & Michela, 1980). The current study highlights the enjoyment of pupils who took part in the PT intervention, with these positive responses linked both to the challenge present in activities and the learning progress they made. It is for this reason that further research into the mechanisms affecting this area should be welcomed, both for academic progress outcomes but also to support affective outcomes of learning.

Evidence based interventions such as PT have an important part to play in supporting fluency for those students who have experienced learning difficulties. This study and others (Roberts, 2012) indicate that staff can require regular support to implement interventions correctly and that flexibility is needed to meet the needs of the individual learner. Despite this challenge, PT remains an evidence based intervention which supports pupil progress. This study indicates that it may also create changes to pupil motivation, and affect changes in participant attributions of internal, unknown and powerful others control. Although causal mechanisms linking increased motivation to changes in literacy behaviour are potentially bi-directional (Becker, et al., 2010), the implication of this research is that through experiencing progress, feedback and challenge through PT, changes to perceptions of causes of success and failure, self-efficacy, and their locus of control over learning outcomes may be affected. Promoting motivation during learning remains a challenging task for staff in the classroom (Stipek, 2002). The elements explored through this study may be invaluable in supporting pupil motivation towards literacy, subsequent progress, and ultimately fulfilment in their learning experiences.

7 References

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8 Appendices

8.1 Appendix 1. Initial email to headteachers/SENCOs in geographical patch

From: Critchley , Anna

Sent: 25 January 2013 11:07

To: 'j.xxxxxxxx@B Local Authority.org'

Subject: Precision Teaching

Dear X,

I wanted to email to keep you updated about the training I have briefly mentioned to you which can be made available to your school during this term. The training will be for teaching assistants in an approach called Precision Teaching. This is a daily intervention which focuses on improving basic literacy skills such as phonics, HFW, and letter formation. Precision Teaching is an evidence based intervention, which closely monitors progress to ensure fluency and accuracy through teaching which precisely matches the individual pupil's progress.

The training would be offered to staff as part of my doctoral research project undertaken with The University of Nottingham and B Local Authority Educational Psychology Service. The research aims to look at male pupils' response to a Precision Teaching programme, and in particular the impact it has on their motivation towards learning. The study is being designed to involve KS2 male pupils who have a particular difficulty with literacy, and is planned to be conducted in the Summer term. The intervention would require pupils to receive a short (maximum 10 minutes) individual daily teaching session led by a Teaching Assistant, with regular monitoring of their progress and motivation, and regular liaison with myself.

As this intervention is part of my doctoral study, the training would be given to schools outside of the current EP time allocation. The training will only be available to a limited number of schools in the first instance, so if you are

interested I would be grateful if you could let me know by email or phone via the contact details below.

If you would like to meet with me to gain further information or have any other queries, please do not hesitate to get in touch.

Many thanks,

Anna

Anna Critchley

Educational Psychologist in Doctoral Training

*Please note, I work in B three days each week (usually Monday - Wednesday)

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B Educational Psychology Service

8.2 Appendix 2: Precision Teaching training presentation

Precision Teaching

Anna Critchley
Educational Psychologist in Doctoral Training

Session outline

- Background theory
- What is Precision Teaching?
- How to use Precision Teaching?

The Learning Hierarchy

Adaptation (without specific instruction)

Generalisation (to novel situations)

Maintenance (proficiency maintained)

Fluency (accuracy and speed)

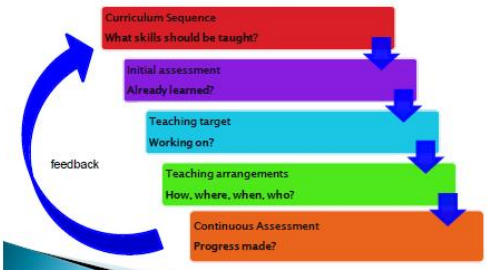
Accuracy (acquisition)

(Haring and Ealn, 1978)

Assessment through teaching

Without assessment there can be no teaching: without teaching there can be no assessment.

Assessment through teaching



What can PT be used for?

Developing children's fluency in fundamental skills which require automatic knowledge:

- Recognition of letters or sounds
- Number recognition
- Key word recall
- Topic or curriculum facts
- Writing letters/words
- Numeracy – bonds to 10, multiples

What is Precision Teaching?

- A way of monitoring what works when you teach.
- Based on monitoring learning taking place during 1-1 regular teaching sessions.
- A way to teach work which is tailored to the child.
- Curriculum-based, relates to specific targets.
- Monitors fine-grain progress.
- Fluency (combination of accuracy and speed), is seen as a crucial skill when learning.
- Promotes the child's motivation to learn.

Main Components of PT

- Identifying a SMART teaching target.
- Teaching to small specific targets
- Recording pupil performance daily (Probing)
- Recording performance daily (Charting)
- Recording session content
- Analysing the data

Phase 1

- Baseline Measurement
- SMART Target

Phase 1

- Baseline measurement: based on national curriculum level, intervention baseline tests, measurement of total range of skills you want the pupil to learn.
- SMART target: identify from this measurement what the pupil doesn't know and make a list of these, placing the most fundamental skills first in the list.

Activity – making a target SMART

James is having difficulty with his phonics knowledge. He can read s, a, t, p but is inconsistent when reading other letter sounds out loud.

Specific target?
How will we know he has achieved this?
When will he have achieved this by?

Activity – making a SMART target

Targets	Strategies/ support	Who/when	Success criteria	Progress
To improve her reading skills.	Use a reading programme with her regularly.	Class TA	Her reading will be more fluent and accurate.	Her reading is still not fluent when reading 1-1. Continue with target.

How could we make this more specific, measureable, attainable, relevant and timed?

Phase 2

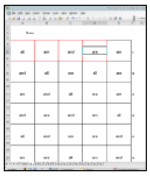
- Teach to the target
- Use daily probe to measure progress (timed)

What is a probe?

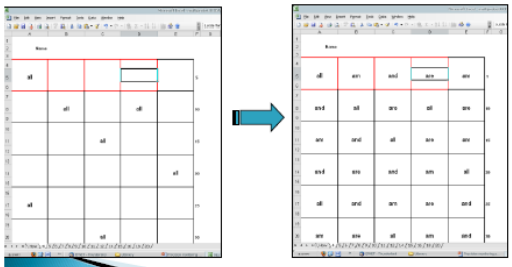
- Daily measure
- Timed measure
- Specific to the skills taught in session
- Specific to the way we've taught skills in session

Creating a daily probe

- What skills have I taught?
- What type of information is this?
- What type of response am I asking for?



Probes



Activity

- Probe sheet

Aim rate:

- Fluency = 60 correct per minute
- No more than 2 errors per minute
- Adaptations to aim rate depend on the type of probe.

Phase 3

- Chart performance

Charting progress

- Correct responses are recorded using a dot, incorrect with a cross.
- These are joined up to give a visual image of progress.
- Charting done with pupil immediately after session.
- 3 day rule
- 8 day rule

Why is charting important?

- It shows relative progress:

Increase of correct responses per minute
5 (rpm) ⟶ 10 =10 rpm ⟶20 rpm and
20rpm ⟶ 40 rpm.

- The chart allows visual analysis of performance.
- Trends in progress can be more easily spotted.
- Motivating for pupil

Activity

- Charting

Phase 4

- Record teaching approach and tasks
- Try different teaching methods

Phase 5

- Review chart progress
- Does the target of teaching approach need to change?
- 'Double check'

Any questions...

Thank you for your time!

*Email addresses

With acknowledgment to good practice training guidance provided by Wigan Local Authority.

8.3 Appendix 3: “Probes” training hand-outs

Probe sheets

What is a probe?

A probe is a very brief daily test which samples the pupil’s performance on the specific skill which is currently being taught.

How to produce a probe sheet:

- Identify an observable and measurable target to be included in the probe. This should be directly measuring the skill currently being taught within the teaching sessions.

- Select the mode suitable for use within the probe. This can be :

a) See-to-say = oral reading of individual words, sounds or sound combinations, oral reading of prose, oral answers to visually presented sums.
b) See-to-write = writing calculation answers, copywriting.
c) Hear-to-write = written spellings or sounds dictated by member of staff, prose dictation.

- Select items relevant for testing. These can be:

a) Single probe = contains items which represent only one specific teaching objective (e.g. words ending in ‘ight’, addition sums using number bonds between 0-10). These are used as a daily measure of progress
b) Mixed probe = contains a mixture of related skills (e.g. a variety of irregular sight words). These are used for ‘double checking’ maintenance of previously learned skills.

- Input items for use into excel spreadsheet to create probe sheet.

- Choose an appropriate time period. 1 minute is usually sufficient, but oral reading of continuous prose or writing may be better sampled over 2-3 minutes.

- Choose an appropriate aim rate (see Aim rates sheet).

Using probe sheets

1) Seating arrangements:

- Find a ‘quiet’ place.
- Sit pupil on the member of staff’s non-writing side.

2) Instructions:

- Encourage the pupil to do better than yesterday, “Let’s try to beat yesterday’s score!”
- Remind pupil about fluency and accuracy “Try to get them right and go as fast as you can”.
- Remind the pupil to try hard but if they find an item difficult to go on to the next word quickly.

3) Timing:

- Say to the pupil, “Get ready”, and then “Go” followed by starting the timer.
- Member of staff watches timer and stops the probe after specified time.

4) Recording:

- Use another copy of the same probe sheet to record pupil responses.
- Use ticks for correct answers and dashes for incorrect answers
- Observe pupil closely to ensure they do not miss an item or line.

5) Unknown items:

- If child gets stuck, pause for 5 seconds and then encourage them to move on. This is because performance is measured within a time limit, if they spend time on answers they don’t know, this will affect their overall score.

6) Cueing:

- If cueing (e.g. by following underneath each item with finger or marker) avoid slowing pupil down by ensuring that the marker is moved on to the next word ahead of pupil responses.

7) Finishing probe:

- If the pupil reaches the bottom of the probe sheet before time, signal for them to begin again at the top of the sheet.

8) Scoring:

- Calculate the number of correct and incorrect responses within the time and write these on top of the probe.

9) Charting:

- Chart results immediately with pupil or allow the pupil to chart for themselves.
- Discuss any changes in performance positively and give a motivational challenge, “Let’s see if we can get more right and less wrong tomorrow!”

10) Ending:

- Always end on a positive and relaxed note, praising effort and focussing on what could be achieved the next day.

8.4 Appendix 4: “Aim Rates” training hand-out

Aim Rates

What is an Aim Rate?

This is the desired level of speed and accuracy we set for the task. Within Precision Teaching this is defined by the rate of correct and incorrect responses given by the pupil in a specific time. The psychological theory suggests that the quicker the pupil can perform the skill correctly, the more likely it is that the pupil will retain that skill.

Identifying the Aim Rate:

- Where the pupil is required to read words from the probe out loud (see-to-say probe), the aim rate is 60 correct per minute with 2 or fewer errors.
- This can be adapted depending on the number of movements involved in the task. For example:

➢ Within phonics, pupils learn to segment and blend sounds. If the probe were to test this process, the number of movements would increase.

	Number of movements involved:
Pupil says: c - a - t	3
c - a - t - ‘cat’	4
c - at	2

The number of movements involved in the task set will affect the number of correct answers expected in the minute probe. In this example, where the pupil is expected to respond c - a - t - cat, the number of correct responses in the Aim Rate would be lowered due to the number of movements required. This could be used to reduce the number of correct answers required to 15 (60 correct

answers/4 movements = 15), or increase the time to 2 minutes, requiring the pupil to give 30 correct answers with 2 or less incorrect answers.

- Within writing probes (see-to-write or hear-to-write), the aim rate would be decreased to suit the needs of the pupil. A pre-test measure should be completed with the pupil where they are required to write a familiar secure word (i.e. their first name or a day of the week) on a sheet of paper for 2 minutes. The number of times the pupil was able to correctly write this word becomes the aim rate for the other probes. A see-to-write probe time would be extended to 2 minutes due to the amount of additional time it takes to write answers as opposed to verbally reading them out.

- This should also be adapted as appropriate to reflect the individual child's needs. For example if a child has fine motor difficulties, the aim rate for a see-to-write probe needs to be lower to reflect this.

8.5 Appendix 5: "Charting" training hand-out

Charting

- The chart provides a quick and easy way to monitor pupil progress. They can be used to help make decisions about what to teach and how to teach it.
- Charting a pupil's progress provides a visual indication of the progress being made. This can support the child's understanding of their own progress.

What does the chart tell us?

- The horizontal axis indicates the day the data was collected. There is a space for each day of the week.
- The vertical axis is used to record the number of correct and incorrect answers per minute when the pupil is doing the probe.

How do we fill the chart in?

- The chart should be completed every day with the pupil after the probe has been done.
- The results from the probe are recorded on the graph in the space corresponding to the day the probe was done. If the child did a probe on a Monday, the Monday horizontal line is used for these results. If the pupil misses a day the line is left blank.
- The number of correct answers is recorded by using a star. The number of incorrect answers is recorded using a dot.

How do we know progress is being made?

- Each pupil will have an aim rate which will be designed to match the skill being taught (see Aim Rate sheet).
- The line made by joining up the correct answers should be going up, and the line made by joining up the incorrect answers should be going down.

How do we know when to change the teaching content?

- By looking at the graph we will be able to see how much progress the pupil is making by looking at the number of incorrect answers written at the bottom of the chart, and looking at the line made by the dots and stars.
- There are also some rules to follow to help us to know when we need to change the teaching content:

- **3 day rule**. During the first 3 days if the line for correct answers only rises a little, stays the same or decreases, this tell us that the task we have set is too difficult. This may require slicing the task, simplifying the task or considering the pre-requisite skills the pupil may need (see examples below*).

- **8 day rule**. After 8 days Precision Teaching expects that the pupil should be at or very nearly at their Aim Rate. If this is not the case this could show us that we need to change our teaching method to increase the pupil's enjoyment of the teaching activities. It may also show us that we need to modify the number of skills we are teaching or the way we are teaching them to help the pupil to learn them faster.

* Task Slice = reduce the number of items to be learned.
* Simplify the task = learn not all CVC words, but only those with the same medial vowel.
* Consider pre-requisite skills = if the pupil is finding CVC words difficult, it may be important to go back to letter sounds and check that the pupil has secure knowledge of these.

8.6 Appendix 6: Myself-As-Learner Scale (MALS) (Burden, 1999)

Burden: The Myself-As-Learner Scale (MALS)

Remember,

a = Yes, definitely
b = Yes, a bit
c = Yes and No, about half and half
d = No, not much
e = Definitely not.

Be as honest as you possibly can. There are no right or wrong answers. We just want to know what you really think about yourself.

1.	I'm good at doing tests.	a	b	c	d	e
2.	I like having problems to solve.	a	b	c	d	e
3.	When I'm given new work to do, I usually feel confident I can do it.	a	b	c	d	e
4.	Thinking carefully about our work helps you to do it better.	a	b	c	d	e
5.	I'm good at discussing things.	a	b	c	d	e
6.	I need lots of help with my work.	a	b	c	d	e
7.	I like having difficult work to do.	a	b	c	d	e
8.	I get anxious when I have to do new work.	a	b	c	d	e
9.	I think that problem-solving is fun.	a	b	c	d	e
10.	When I get stuck with my work I can usually work out what to do next.	a	b	c	d	e
11.	Learning is easy.	a	b	c	d	e
12.	I'm not very good at solving problems.	a	b	c	d	e
13.	I know the meaning of lots of words.	a	b	c	d	e
14.	I usually think carefully about what I've got to do.	a	b	c	d	e
15.	I know how to solve the problems that I meet.	a	b	c	d	e
16.	I find a lot of schoolwork difficult.	a	b	c	d	e
17.	I'm clever.	a	b	c	d	e
18.	I know how to be a good learner.	a	b	c	d	e
19.	I like using my brain.	a	b	c	d	e
20.	Learning is difficult.	a	b	c	d	e

8.7 Appendix 7: Mutidimensional Measure of Children's Perceptions of Control (MMCPC) (limited to cognitive domain questions)

Instructions: This is not a test. It is just a way of trying to find out why you think you do well at some things and not so well at others. There are no right or wrong answers, but it is important that you complete all the items as honestly as you can.

Please read the following statements (or listen to them being read to you). Decide how far each statement is true of you or not in literacy this week at school. It it's not at all true, please put a tick in the box under the answer NOT AT ALL TRUE. If it's not very true, please put a tick in the box under the answer NOT VERY TRUE. If it's sort of true, put a tick in the box under SORT OF TRUE. If it's very true, put a tick in the box under VERY TRUE.

	Not at all true	Not very true	Sort of true	Very true
1. U (7) When I do well in school, I usually can't figure out why.				
2. P (27) When I do well in school, it's because the teacher likes me.				
3. U (22) If I get a bad mark at school, I usually don't understand why I got it.				
4. P (42) If I don't have a good teacher, I won't do well in school.				
5. I (9) If I want to do well in school, it's up				

to me to do it.

6. U (46) When I don't do well in school, I usually can't figure out why.

7. U (31) When I get a good mark in school, I usually don't know why I did so well.

8. P (3) The best way for me to get good marks is to get the teacher to like me.

9. I (38) If I get bad marks, it's all my own fault.

10. I (35) If I want to get good marks in school, it's up to me to do it.

11. P (18) If I have a bad teacher, I won't do well in school.

12. I (14) If I don't do well in school, it's my own fault.

8.8 Appendix 8: Staff questionnaire

Instructions:

Please tick one box to rate how well these statements describe the pupil's behaviour in literacy lessons this week.

In class this pupil:	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Often gives up or won't try in the belief that he lacks the ability to tackle the task (e.g. "I can't do this, it's too hard for me").					
Often does not make any serious attempt to tackle a difficult task in order to avoid the risk of failure (e.g. "It's boring" or "Who wants to do that anyway").					
When he does not understand something or gets a low mark, he makes genuine efforts to overcome the problem (e.g. by seeking advice or working out a different approach).					
He is motivated to do things which are primarily interesting, fun or challenging to him without needing an external pressure or reward.					

He is motivated to do things which are a means to an end or meet an external demand.					

8.9 Appendix 9: Staff feedback pro-forma

Pupil name:

Staff member:

Date of feedback

Interview:

1. How have you used PT in this research project?
    - Regularity?
    - Teaching resources
    - Probe until topic exhausted

2. How have you found using Precision Teaching?
    - Highlight pragmatics
    - Highlight specific elements of PT
    - Highlight areas of thesis project if necessary
    - Probe until topic exhausted

3. How did the pupil you worked with respond to PT?
    - Elements of competition?
    - Elements of negativity?
    - Probe until topic exhausted.

4. What changes have you noticed about the pupil you've worked with in this time?
    - Practical changes (sleep, absences, friendships, family changes, any other factors affecting engagement in school)
    - Changes in learning attainment
    - Changes in confidence
    - Changes in motivation towards literacy
    - Changes in motivation towards learning
    - Probe until topic exhausted

5. What do you think could be reasons for these changes?

- Probe on attainment improvement (achievement motivation)
- Probe on peer comparison/staff instruction (extrinsic motivation)
- Probe on ownership of learning (intrinsic motivation)
- Ask about differences noted by staff between interventions with and without PT to monitor progress.
- Probe until topic exhausted

This overview of the discussion was emailed to the member of staff for review on ….INSERT DATE HERE... They responded to indicate this was a true reflection of the discussion which took place and represented their feedback on the Precision Teaching project.

8.10 Appendix 10: Pupil semi-structured interview pro-forma

General probes to be used:

Tell me more about that…

How come?...

Addition - encouragement, body movement, silence

Reflecting - echo, question-to-question, attentive listening

Transition - cued, reversion, mutation

Situation - re-presentation, environmental walk through, reconstruction

Emotion - feeling, projection, attentive listening

Personal - self-description, parallel.

Introductory comments:

Thank you for being willing to meet with me for this follow up interview to the study. Doing this interview is completely voluntary - you don't have to take part. You are free to stop at any point before, during or after the interview. Some of these questions might sound silly or might be a bit tricky to answer. There are no right or wrong answers, I'm interested in what you think. All of the answers you give in this interview will be recorded using a voice recorder but no-one who reads what you said will know it was you who gave these answers. The answers you give will be used as part of my research project. Are you still ok to continue with our discussion?

Interview:

6.

- Regularity?
- Teaching resources
- Teaching content
- Working with TAs

- Probe until topic exhausted

7. What were your PT sessions like? How did you find doing the PT sessions?
   - Highlight pragmatics - every day, being away from class.
   - Members of staff working with?
   - Graphs
   - Activities (specific questions relating to area of literacy the pupil was focussed on)
   - Doing the daily probe test
   - Classroom context where PT was completed
   - Probe until topic exhausted

8. Tell me about any changes you noticed in your literacy skills during the Precision Teaching sessions.
   - Changes in learning ability in specific skill pupil was practicing
   - PCP? Do you think staff noticed any changes?
   - Do you think parents/carers noticed any changes?
   - Do you think friends would have noticed any changes?
   - Probe until topic exhausted

9. Can you tell me more about what you think made these changes happen? THIS IS KEY QUESTION
   - Did your teachers do anything to make these changes happen? Probe on peer comparison/staff instruction/ home instruction (extrinsic motivation)
   - Did other pupils do anything to make these changes happen?
   - Did you do anything to make these changes happen? Probe on ownership of learning (intrinsic motivation)
   - Practical changes (sleep, absences, friendships, family changes, any other factors affecting engagement in school)
   - Probe on attainment improvement (achievement motivation)

10. What did the Precision Teaching sessions make you feel about what you were learning?
    - Did you notice any changes in your feelings about literacy during doing Precision Teaching?
    - Changes in motivation towards literacy?
    - Changes in confidence?
    - Elements of competition?
    - Elements of negativity?
    - Is being good at literacy important? How come? (PCP laddering?)
    - Probe until topic exhausted.

11. What activities do you do in literacy? Reading, spelling, writing activities?
    - What do you like/dislike in literacy? How come?
    - How do you think PT is different to other ways you've been taught literacy?
    - Probe until topic exhausted

<u>Closing comments</u>

After this interview I'm going to write down the conversation we had. I'd like to write about this conversation in my research project. Some other people might listen to our conversation to check I've written it down correctly. Do you still agree to me including our conversation? Thank you again for meeting to talk with me.

8.11 Appendix 11: Pilot study staff feedback sheet

Staff questionnaire: Pupil Motivation and Behaviour in school.

Instructions:

Please tick only one box in response to each of the statements regarding a pupil's behaviour in school lessons over the past week.

In class this pupil:	Yes	Probably yes	No	Probably no
Often gives up or won't try in the belief that he lacks the ability to tackle the task (e.g. "I can't do this, it's too hard for me").				
Often does not make any serious attempt to tackle a difficult task in order to avoid the risk of failure (e.g. "It's boring" or "Who wants to do that anyway").				
When he does not understand something or gets a low mark, he makes genuine efforts to overcome the problem (e.g. by seeking advice or working out a different approach).				

Please rate how well these statements describe the pupil's behaviour in school lessons this week.

1. He is motivated to do things which are primarily interesting, fun or challenging to him without needing an external pressure or reward.

Strongly disagree		Disagree	Neutral	Agree Strongly agree
1	2	3	4	5

2. He is motivated to do things which are a means to an end or meet an external demand.

Strongly disagree		Disagree	Neutral	Agree Strongly agree
1	2	3	4	5

<u>Please give as much information as possible to answer the following questions on the usability of this questionnaire.</u>

- How well do you think the questions are phrased? Are there any parts or words that are confusing or could be made clearer?

……
……
……
……
……
……

- Is there anything you found difficult about using the rating scale using “yes, probably yes, no, probably no”? Are there any changes you would make?

……
……
……
……
……
……

- Is there anything you found difficult about using the rating scale using “Strongly disagree, disagree, neutral, agree, strongly agree”? Are there any changes you would make?

……
……
……
……
……
……

- Please use the space below to give any further feedback about this questionnaire.

……
……
……
……
……
……

8.12 Appendix 12: Pupil pilot study delivery of measures and feedback questions

Instructions:

This is not a test. It's just a way of trying to find out why you think you do well at some things and not so well at others. There are no right or wrong answers, but it is important that you complete all the items as honestly as you can.

Please read the following statements (or listen to them being read to you). Decide how far each statement is true of you or not. It it's not at all true, please put the statement in the envelope marked NOT AT ALL TRUE. If it's not very true, please put the statement in the envelope marked NOT VERY TRUE. If it's sort of true, put the statement in the envelope marked SORT OF TRUE. If it's very true, put the statement in the envelope marked VERY TRUE.

Do you understand what you need to do?

Let's go!

Questions:

1. Would it have worked better for you if you had an example at the start to help you understand what to do? What would this have been?
2. Did you understand the questions?
3. Did you feel the answer options covered what you wanted to say? Could they have been different?
    - Would it have helped if "not very true" was something different?
    - What would have been better answers?
4. Did you prefer the answers from the previous questionnaire (MALS)?
5. Was there anything else about this that would have made it easier for you?

8.13 Appendix 13: Precision Teaching intervention fidelity checklist

Check	Present ?	Notes
Are a limited number of items used within the sessions (maximum 5)?		
Does the session continue for 10 minutes or less?		
If a pupil is inaccurate on an item during the teaching session, is this item re-taught?		
Does the probe match the items and method of teaching used in the teaching session?		
Is the pupil prompted to move on if pausing for longer than 5 seconds on a word within the probe?		

Is the probe accurately timed for the set time?		
Is the mastery criteria of reaching the Aim Rate used to move the pupil on to the next items?		
Is the session taking place in a quiet space?		
Is the session taking place on a table with no other table-top activities present?		
Is the graph completed with the pupil following the probe?		

Does the Teaching Assistant refer to the Aim Rate and encourage the pupil to “try to beat the score tomorrow”?		

Date: School: Member of staff:

8.14 Appendix 14 Parent research project information sheet

Information Sheet

I am a student at The University of Nottingham, and I am doing a research project which aims to look at whether an intervention called Precision Teaching increases boys' motivation towards literacy and learning. Alongside studying I currently work as a Trainee Educational Psychologist in B Local Authority. This project is being completed with support from the B Local Authority Educational Psychology Service and supervised by Nick Durbin from The University of Nottingham. This is an information sheet to explain about this research project and to invite you to take part. Your school has been approached for involvement in this study because you are within the patch of schools designated to Anna Critchley and you have not previously received training in the Precision Teaching approach.

It is important for you to understand why the research is being done and what it will involve, prior to agreeing to be involved in the study. Please take time to read the following information carefully and discuss it with others if you wish.

This study involves a member of staff teaching literacy skills to pupils and monitoring progress through Precision Teaching. This research project is also interested in the effect this intervention has on pupil motivation to learn. From previous research, Precision Teaching has been shown to be an effective way of monitoring pupil progress and matching teaching to the level the pupil is ready to learn. This study focuses on male pupils who are having difficulties with literacy. Within the project, each teaching assistant will be completing a teaching session with the chosen pupil regularly. After each teaching session, pupil progress will be monitored through the Precision Teaching probes and graph completion. Staff will receive training in Precision Teaching. I will be meeting with each pupil once each week to measure their motivation towards learning through a short questionnaire which the pupil will complete. Each week you will also be asked to complete a short questionnaire to rate the pupil's

motivation in the last week. During this weekly visit I will also be completing a short measure of pupil progress. I will then be available to check in with you about how the Precision Teaching is going, and to collect the daily data which has been gathered that week.

I will be arranging to be present during some teaching sessions during the Summer term to support your delivery of the intervention and make sure this is in line with the training. I will be available to support you with any questions or queries throughout the project via the email and telephone contact details below. The research project will be in place during the Summer term 2013 (i.e. between April and July). The Precision Teaching intervention will last a maximum of 10 weeks. However, this is dependent on the pupil's individual targets and progress during the intervention. The research project will start with a few weeks of the pupil completing the weekly motivation measure without Precision Teaching in place. During this time, staff can choose a teaching method to use. This is to get a baseline level of the pupil's motivation so that we can see if changes to motivation are caused by Precision Teaching. This will then be followed by implementing the Precision Teaching approach.

Participation in this study is completely voluntary and you are under no obligation to take part. You are free to withdraw at any point before, during or after the study. All data collected will be kept confidential and used for research purposes only.

If you have any questions or concerns please don't hesitate to ask now. I can also be contacted after your participation at the following email address: lpxac4@nottingham.ac.uk

Thank you for taking the time to read this information.

A. Critchley

Anna Critchley
Trainee Educational Psychologist.

Contact Details

Researcher/Trainee Educational Psychologist: Anna Critchley
Email: annacritchley@B Local Authority.gov.uk
Phone: 01226 773574

Supervisor: Nick Durbin
Email: lpzdur@exmail.nottingham.ac.uk
Phone: 0115 846 7242

Acting Senior Educational Psychologist: Rachel Massey

Phone: 01226 773577

8.15 Appendix 15 Pupil research project information sheet.

The University of Nottingham
UNITED KINGDOM · CHINA · MALAYSIA

Dear

This is written to tell you about a research project that you could take part in at school. This would involve you doing some teaching sessions to help your literacy skills.

These teaching sessions would involve…

- Working 1-1 with a teaching assistant in a space separate from the rest of your class.
- Doing some literacy activities for 5 minutes each day.
- Doing a Precision Teaching timed 1 minute task to see how much you've learned after some of the teaching sessions.
- Answering some questions once each week to see what it feels like when you find learning difficult and easy.
- Doing a questionnaire before and after the project asking about your feelings about learning.

Being part of these teaching sessions would mean that you might have to concentrate and work on things you find a bit difficult. The teaching assistant is there to help you if you do find something hard.

How much you learned and your feelings about difficult and easy learning would be recorded to be written about by the Educational Psychologist. All of this information would be kept very safe, and the written piece of work wouldn't include your name. This means that anybody who read about the research project wouldn't know you were involved.

If you started the Precision teaching sessions or the questionnaires and they were making you feel upset or worried, you can tell your teaching assistant. You would not be in trouble and the Precision Teaching would then stop. If at any time you don't want your information to be written about by the Educational Psychologist you can tell the teaching assistant. Your information would then not be included in the Educational Psychologist's written work.

Your family know about these teaching sessions. If you want to you can discuss it with them before you decide whether you want to take part or not. If you have any questions about this research project or Precision Teaching, please ask the person who is reading this with you.

8.16 Appendix 16 Staff research project information sheet

Information Sheet

I am a student at The University of Nottingham, and I am doing a research project which aims to look at whether an intervention called Precision Teaching increases boys' motivation towards literacy and learning. Alongside studying I currently work as a Trainee Educational Psychologist in B Local Authority. This project is being completed with support from the B Local Authority Educational Psychology Service and supervised by Nick Durbin from The University of Nottingham. This is an information sheet to explain about this research project and to invite you to take part. Your school has been approached for involvement in this study because you are within the patch of schools designated to Anna Critchley and you have not previously received training in the Precision Teaching approach.

It is important for you to understand why the research is being done and what it will involve, prior to agreeing to be involved in the study. Please take time to read the following information carefully and discuss it with others if you wish.

This study involves a member of staff teaching literacy skills to pupils and monitoring progress through Precision Teaching. This research project is also interested in the effect this intervention has on pupil motivation to learn. From previous research, Precision Teaching has been shown to be an effective way of monitoring pupil progress and matching teaching to the level the pupil is ready to learn. This study focuses on male pupils who are having difficulties with literacy. Within the project, each teaching assistant will be completing a teaching session with the chosen pupil regularly. After each teaching session, pupil progress will be monitored through the Precision Teaching probes and graph completion. Staff will receive training in Precision Teaching. I will be meeting with each pupil once each week to measure their motivation towards

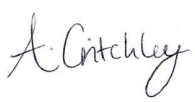
learning through a short questionnaire which the pupil will complete. Each week you will also be asked to complete a short questionnaire to rate the pupil's motivation in the last week. During this weekly visit I will also be completing a short measure of pupil progress. I will then be available to check in with you about how the Precision Teaching is going, and to collect the daily data which has been gathered that week.

I will be arranging to be present during some teaching sessions during the Summer term to support your delivery of the intervention and make sure this is in line with the training. I will be available to support you with any questions or queries throughout the project via the email and telephone contact details below. The research project will be in place during the Summer term 2013 (i.e. between April and July). The Precision Teaching intervention will last a maximum of 10 weeks. However, this is dependent on the pupil's individual targets and progress during the intervention. The research project will start with a few weeks of the pupil completing the weekly motivation measure without Precision Teaching in place. During this time, staff can choose a teaching method to use. This is to get a baseline level of the pupil's motivation so that we can see if changes to motivation are caused by Precision Teaching. This will then be followed by implementing the Precision Teaching approach.

Participation in this study is completely voluntary and you are under no obligation to take part. You are free to withdraw at any point before, during or after the study. All data collected will be kept confidential and used for research purposes only.

If you have any questions or concerns please don't hesitate to ask now. I can also be contacted after your participation at the following email address: lpxac4@nottingham.ac.uk

Thank you for taking the time to read this information.



Anna Critchley

Trainee Educational Psychologist.

Contact Details

Researcher/Trainee Educational Psychologist: Anna Critchley

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Phone: 01226 773574

Supervisor: Nick Durbin

Email: lpzdur@exmail.nottingham.ac.uk

Phone: 0115 846 7242

Acting Senior Educational Psychologist: Rachel Massey

Phone: 01226 773577

8.17 Appendix 17 parent consent form for pupil interview

The University of Nottingham
UNITED KINGDOM · CHINA · MALAYSIA

CONSENT FORM

Research Project Title: Investigating the effect of Precision Teaching on the self-efficacy and motivation towards learning of male pupils in Years 5 and 6.

Researcher: Anna Critchley *(Trainee Educational Psychologist).* School of Psychology, The University of Nottingham.

This consent form is for the parents/carers of …….... to complete and sign.

Thank you for your child's participation so far in the Precision Teaching project. This letter is to ask your permission to do a further interview with your son. This would involve your son meeting with the researcher (Anna Critchley) to answer some questions about the Precision Teaching project and their feelings about literacy and learning. This interview has been designed to find out more about what pupils thought of the Precision Teaching intervention, and their feelings of motivation towards learning and literacy. The interview will be recorded using an audio tape recorder. This recording will be listened to by the researcher and short sections may be heard by research support personnel whilst validating analysis of the data. The audio tape recording will be analysed and used for research purposes only. The audio recording will be stored securely and confidentially. The direct recording will be destroyed when the researcher has fully analysed the information. If you would like any further information about the Precision Teaching project or this interview, please contact me on the details overleaf.

- Have you read and understood the above information?

  YES/NO

- Have you had the opportunity to ask questions about the interview and research project?

  YES/NO

- Have all your questions been answered satisfactorily?

  YES/NO

- Have you received enough information about the interview?

  YES/NO

- Do you agree to your child taking part in the interview?

  YES/NO

“I agree to my child taking part in an interview with the researcher which will be recorded using a tape recorder.”

Signature of the Parent/Carer ……. Date ……..

Name (in block capitals):

……..……..

This study has been explained to the above parents/carers and they have agreed that their son should take part.

Signature of researcher …… Date ……......

Contact Details

Researcher: Anna Critchley

Email: annacritchley@B Local Authority.gov.uk

Phone: 01226 773574

Supervisor: Nick Durbin

Email: lpzdur@exmail.nottingham.ac.uk

Phone: 0115 846 7242

8.18 Appendix 18 Pupil consent form for interview

Please read the questions below and tick yes (if you agree) or no (if you disagree).

	Yes	No
Have you been able to ask questions about the interview?	☐	☐
Have your questions been answered?	☐	☐
Do you know that you can stop doing the interview whenever you want to?	☐	☐
Do you agree to doing the interview and for it to be recorded?	☐	☐

This interview has been explained to me by Anna Critchley and I agree to take part.

Signed .....

8.19 Appendix 19 Staff Research project debrief sheet

The University of Nottingham
UNITED KINGDOM · CHINA · MALAYSIA

Debrief Information Sheet

Dear

Thank you for agreeing to be involved in this research project. The information gathered from this research project aimed to monitor progress in a basic literacy skill and investigate whether the intervention Precision Teaching made any changes to the level of motivation that pupils felt towards learning.

All the information gathered will now be written up as part of my Educational Psychology Doctoral thesis. All information gathered from the project will remain confidential and all names will be anonymised. If for any reason you would prefer to have your information removed from the write up of the study, please contact me on lpxac4@nottingham.ac.uk.

I hope you have enjoyed being part of this project. I will be contacting your school again in September to provide further feedback or follow up information. In the meantime, may I thank you again for your participation and support for this project.

Yours sincerely,

A. Critchley

Anna Critchley
Trainee Educational Psychologist.

Contact Details

Researcher: Anna Critchley

Email: annacritchley@B Local Authority.gov.uk

Phone: 01226 773574

Supervisor: Nick Durbin

Email: lpzdur@exmail.nottingham.ac.uk

Phone: 0115 846 7242

8.20 Appendix 20 Pupil Research Project debrief sheet

Dear

The University of Nottingham
UNITED KINGDOM · CHINA · MALAYSIA

Thank you for being involved in this research project. I hope that you've enjoyed

the Precision Teaching sessions you had with the Teaching Assistant, and that you have been able to see how much you've learned over this term.

I hope that you didn't find this learning too difficult, well done for keeping going when you had to concentrate hard!

How much you learned and how much you liked learning is now going to be written about by the Educational Psychologist. All of this information will be kept very safe, and the written piece of work wouldn't include your name. This means that anybody who reads about the research project won't know you were involved.

If for any reason, you don't want this information about you to be included in the written piece of work, please tell your Teaching Assistant or parent who will let me know. After the summer holiday I will be getting in touch to give you, your teachers and your parents a bit more information and feedback about the project.

Thank you again for being part of this research project. You have been very helpful and this project will hopefully help other researchers to know more about how to help other children with their learning in the future.

Yours sincerely,

A. Critchley

Anna Critchley

Trainee Educational Psychologist

8.21 Appendix 21. Pupil A thematic analysis full data

Theory of motivation	Overall theme	Sub-theme	Data example
Attribution theory	location of attribution	internal attribution of learning change	**A:** I found it easy to draw on the dots… **A:** It [charting] was easy, cos all you needed to do was count them. **A:** I'm getting more…like at first I'd only get to here *(pointed to half way down the timed probe sheet)* and I'd get about two wrong, and then I like start getting here and then to here (*pointing to further down the timed test)* **A:** …and then I was getting them all right! **Interviewer:** Ah ok…[pause] so what did you do to get better at those words? **A:** Like practiced them [HFW] and that…practiced them. **A:** I'm getting faster and I'm getting more right. **A:** I don't like writing before I start but like when I start I'm not bothered, I just do it.

			A: I can go to college and like have more on my mind so like I can know.
		external attribution of learning change	**A:** Peaceful… I could concentrate. **Interviewer:** Right, cos being quieter helps you concentrate? **A:** Yeah…I didn't get put off **Interviewer**: What was it like working with Mrs H and Mrs S? **A:** Good because they're my best teachers. **Interviewer**: "What so good about them [teaching staff]?" **A:** "Like they've been…helped me since I've been in…well since I first started school" **Interviewer:** Oh I see, and when they came over and helped you what were they doing? **A:** Like helping me read hard words and the ones I were stuck on and that **A:** "They don't really shout or like…they just tell you…give you three warnings if

			you've been bad and give you a chance to like stop being bad." **A:** "they [teaching staff] like let me have three chances." **A:** "it [Precision Teaching sessions] like made it easier to read my books and all that...in class." **A:** It [Precision Teaching] did help cos on a morning we weren't doing owt, all we were doing is like reading a book or doing the register so…she shouted me and we did that [PT activities]. **A:** It [morning routine] gets me awake so I'm awake to do this **A:** I must not have had a good sleep **Interviewer:** Ok, so they didn't do anything to make the changes happen? Who did then? **A:** The teachers… **A:** this *(pointed to PT activities on the table)* helped me with my reading, like

			reading the words and that, like that comes up and they come up a lot in my books and that…so it helped me.
		unknown attribution of learning change	**Interviewer:** The teachers…[pause] ok, did anyone else help those changes to happen? **A:** [Pause] Dunno… **Interviewer:** so that red line's going down, it seems to be going up a bit and down a bit that red line, doesn't it? I wonder why that red line's going up and then down? **A:** [Pause, shrugs shoulders]
	locus of control over learning	increase in learning success stability	**A:** …and then I was getting them all right!

		instability of learning progress	**A:** I'm getting more…like at first I'd only get to here *(pointed to half way down the timed probe sheet)* and I'd get about two wrong, and then I like start getting here and then to here *pointing to further down the timed test* **A:** I'm getting faster and I'm getting more right. **A:** It made me feel happy cos <u>like when I'm older I can learn</u>
		Element of pupil control over learning progress	**A:** Because it's like…[Pause] just learning my…some of those words come up in a book and it's like I can read it so…like I just know them words. **A:** she were like saying you're doing better than you were doing before… **Interviewer:** So what did you do to get better at those words? **A:** Like practiced them and that…practiced them and put them on the graph.
		Element of uncontrollability over learning	**A:** it [Precision Teaching] like made it easier to read my books and all that...in class.

		progress	**Interviewer**: What so good about them [teaching staff]? **A:** Like they've been…helped me since I've been in…well since I first started school. **Interviewer:**...so when you got stuck they would kind of come over and…what would they do….would they… **A:** ….like read that word to me and then I'll read on… **A:** this *(pointed to activities on the table)* helped me with my reading, like reading the words and that, like that comes up and they come up a lot in my books and that…so it helped me **A:** I must not have had a good sleep **Interviewer:** What was it like working with Mrs H and Mrs S? **A:** Good because they're my best teachers **A:** They [teaching staff] don't really shout

	Social comparison	Others noticing learning changes	**Interviewer:** Do you think if I asked them when you were doing your Precision Teaching sessions I asked your friends, what would they think about your reading? **A:** L might [another pupil doing PT]…him who's coming in next…cos he's in my reading group and all that… **A:** I'd read to her [mum] and like she might think I've got better.
	Self-perception as a learner	Increased task competence	**A:** it like made it easier to read my books and all that...in class. **A:** she were like saying you're doing better than you were doing before…
Social learning theory	Value of goal	Future focus for achieving goal	**A:** I can go to college and like have more on my mind so like I can know. **Interviewer:** so for you A is being good at literacy and reading, is that important? **A:** Yeah **Interviewer:** How come? **A:** Because it's going to like help me in the future
	Expectancy of goal occurring	Increase in skills/success	**A:** Because it's like…[Pause] just learning my…some of those words come up in a book and it's like I can read it so…like I just know them words.

			A: I kept getting further and further along (*in timed test).* **A:** …and then I was getting them all right! **Interviewer:** you knew you were getting faster? **A:** Yeah **A:** she [Teaching Assistant] were like saying you're doing better than you were doing before… **A:** I'm getting faster and I'm getting more right. **A:** I'm just getting better.
		Practice using literacy skills	**A:** you had to use your memory and that… **Interviewer:** Do you think it did help or didn't help to do it every day? **A:** It did help

			A: we plan stories and that, and then we'll write them in us books **A:** we'll do a big read or summat... **A:** every week we'll do a different story and a different reading comprehension
Achievement theory	Hope of success	Positive about improvements made	…and then I was getting them all right! **A:** It made me feel happy cos like when I'm older I can learn And then if I need to do a test thing or summat in college, like I'll know my reading and all that
	Intrinsic need for achievement	positive opinion of achievement	**Inteviewer:** What did the Precision Teaching sessions make you feel about what you were learning? **A:** It made me feel happy cos like when I'm older I can learn **Interviewer:** so for you A is being good at literacy and reading, is that important? **A:** Yeah **Interviewer:** How come?

			A: Because it's going to like help me in the future
	Value of success	Internal motivation to achieve success/goals	**A:** It made me feel happy cos like when I'm older I can learn **A:** I can go to college and like have more on my mind so like I can know.
	Need for achievement	External motivation to achieve success/goals	**A:** I'll do it…yeah I'll do it if I have to but... **Interviewer:** But… **A:** But I don't really like it. **A:** And then if I need to do a test thing or summat in college, like I'll know my reading and all that
		Positive about avoiding failure	**A:** And then if I need to do a test thing or summat in college, like I'll know my reading and all that
	Affect	Positive	**A:** It's just fun **A:** Fun **Interviewer:** What did the Precision Teaching sessions make you feel about

			what you were learning? **A:** It made me feel happy
	Challenge	Positive presence of challenge	**A:** It's just fun…cos you like got to use your memory and like see where…and like it was a bit difficult….and you had to use your memory and that.
		Presence of challenge in session activities	**Interviewer:** Yeah…and it was a bit difficult did you say? **A:** Not to read or owt…but it were just like to find them and that… **A:** I'm getting faster and I'm getting more right.
		PT monitoring produced challenge	**A:** Like, she'll look at her clock and tell me when to start and see how fast I can do all of them..in a minute…and if I did em all in less than a minute then I have to start again and try to do it…

8.22 Appendix 22 Pupil B thematic analysis full data

Theory of motivation	Overall theme	Sub-theme	Data example
Attribution theory	location of attribution	internal attribution of learning change	**B:** "words that like I got stuck on and then like keep learning them and learning them until then I could do em." **B:** I were getting more things right and all that." **B:** "I were reading quicker and I was reading more words" **Interviewer: "**how did you feel you helped to make those changes happen to your reading?" **B:** "Paid more attention" **Interviewer:** And if I saw you paying more attention in those teaching sessions what would that look like B? What would I see you doing? **B:** Working more**.** **B:** "I'd just spell words more correctly"

			B: “I’ve been like on tests and in my reading I’m doing better and that.” **Interviewer:** “What would I see you doing or your group doing or your class.” **B:** “working harder”
		external attribution of learning change	**Interviewer: “**And what was good about working with those teachers?” **B:** “Erm, normally other teachers, they just, they’re like…other teachers you get something wrong they won’t like…they’ll just make you wait there until you finish it. But they’re just like you miss one word or whatever and you just keep on reading the sentence or whatever…” **B:** “They [Teaching Assistants] just showed us words and in any sentence, and just like let you miss that one out and you keep on reading it and you just like come back to it.” **B:** “It [timed test] was proper good…because it’s helping me like get better at words and that.” **Interviewer: “**what was it like working in that area of the classroom?” **B:** “Erm…well that was like a quiet bit so it were alright…You can just

			concentrate more." **Interviewer: "**I wonder if you can tell me any more about why you think these changes happened?**"** **B: "**By doing this [Precision Teaching sessions]" **Interviewer: "**Ok did your teachers do anything to make those changes happen or to help those changes to happen in your reading?" **B:** "Like helping me like read things" **Interviewer:** "What did they do to help you to read things? If I saw them helping you to read something, what would I see them doing?" **B:** "Encouraging me" **Interviewer:** tell me what did you like about these sessions, what did you like about it? **B:** Making me improve in my reading
	locus of control	Literacy progress stability	**B:** I'd just spell words more correctly... **B:** I've been like on tests and in my reading I'm doing better and that.

		Instability in learning progress	**B:** They just showed us words and in any sentence, and just like let you miss that one out and you keep on reading it and you just like come back to it. **B:** they're just like you miss one word or whatever and you just keep on reading the sentence or whatever… **B:** it's [Precision Teaching sessions] helping me like get better at words and that. **B:** I were reading quicker and I was reading more words **Interviewer:** You were getting more things right? **B:** Yeah…In like my reading tests and all that cos I've been reading them and all that
		Progress controlled by pupil	**B:** words that like I got stuck on and then like keep learning them and learning them

			B: at first it was a bit harder but then it got easier. **B:** cos I've been reading them and all that, and it helped me with my reading so… **B:** I were reading quicker and I was reading more words **Interviewer:** how did you feel you helped to make those changes happen to your reading? **B:** Paid more attention **B:** Working more **Interviewer:** What would I see you doing or your group doing or your class. **B:** working harder
		Progress not controlled by pupil	**Interviewer:** what was good about working with those teachers? **B:** Erm, normally other teachers, they just, they're like…other teachers you get something wrong they won't like…they'll just make you wait there until you finish it.

			Interviewer: what was it like working in that area of the classroom? **B:** Erm…well that was like a quiet bit so it were alright…You can just concentrate more. **Interviewer:** Ok did your teachers do anything to make those changes happen or to help those changes to happen in your reading? **B:** Like helping me like read things
	Self-perception as a learner	Increased competence	**B:** keep learning them and learning them until then I could do em. **B:** at first it was a bit harder but then it got easier. **B:** I were getting more things right and all that **B:** I've been like on tests and in my reading I'm doing better and that.
Social learning theory		PT supporting awareness of competence	**Interviewer:** So you did the dots on here, and what did they mean? **B:** Erm where I've reached and that… so it [chart] would tell me where I'd got to.

	Value of goal	Limited value of literacy	**Interviewer:** Is there anything that you particularly love in literacy, or really like doing? **B:** No, I'm kind of in the middle **Interviewer:** for you B, is being good at reading or at literacy, is that an important thing to you or not so important? **B:** I'm not bothered me. **Interviewer:** are you saying that literacy - it's not that important, or it's a bit important, or that it's really important, or something different? **B:** Just a bit important.
		Value of literacy skills as distinct from tests	**B:** In these sheets (*pointing to words and sheets in front of him)* they're just like words and they're like, they don't really like matter…well they do but for your learning and that but like…[pause]… They <u>do</u> matter but they don't, they don't go into like our thingys for our levels and they're just like there to help me and that.
		Social value of	**Interviewer:** why do you need to get a good level B?

		achieving literacy goal	**B:** So I can do something good with my life...well like my sister she had good levels and so she went into the army…
	Expectancy of goal occurring	Increase in skills	**B:** it's [Precision Teaching sessions] helping me like get better at words and that. **B:** I were reading quicker and I was reading more words **B:** Erm…just because we didn't just get one sheet, we kept swapping them after about, after a week of them, we kept swapping the sheets what we were doing. **Interviewer:** Ah and what was on the new sheet? **B:** Harder words **B:** I'd just spell words more correctly
		Increase in success	**B:** I were reading quicker and I was reading more words **B:** I'd just spell words more correctly
Achievement theory	Hope of success	Positive about making improvement	**B:** at first it was a bit harder but then it got easier. **B:** It [timed test] was proper good…because it's helping me like get better at

			words and that. **Interviewer:** …what did you think when you saw what you'd got? **B:** [Pause] That I were doing good **Interviewer:** Ok they're [probes] just there to help you. Ok and what do you think about that? **B:** It's good **Interviewer:** And why, what about that is good? **B:** Because it's making me improve in my like reading and spelling.
		PT supported awareness of learning change	**B:** so it [chart] would tell me where I'd got to **Interviewer:** …what did you think when you saw what you'd got? **B:** [Pause] That I were doing good **B:** we'd put em on that chart thing that were like wherever the dots are it tells you what I got and… it showed me what I were doing and that.

		PT increased probability of learning change	**Interviewer:** I wonder if you can tell me any more about why you think these changes happened? **B:** By doing this [Precision Teaching activities] **Interviewer:** Ok, and is there anything in particular in this, in the teaching sessions that you thought particularly made the changes happen? **B:** Erm…just because we didn't just get one sheet, we kept swapping them after about, after a week of them, we kept swapping the sheets what we were doing. **Interviewer:** Ah and what was on the new sheet? **B:** Harder words **B:** It's [timed PT probe sheets] making me improve in my like reading and spelling.
	Intrinsic need for achievement	Positive view of achievement	**Interviewer:** …what did you think when you saw what you'd got? **B:** [Pause] That I were doing good **:** In these sheets (*pointing to words and PT probess in front of him)* they're just like words and they're like, they don't really like matter…well they do but for

			your learning and that but like…[pause]… They <u>do</u> matter but they don't, they don't go into like our thingys for our levels and they're just like there to help me and that… **Interviewer:** Ok they're just there to help you. Ok and what do you think about that? **B:** It's good **Interviewer:** And why, what about that is good? **B:** Because its making me improve in my like reading and spelling. **Interviewer:** are you saying that literacy - it's not that important, oh it's a bit important, or that it's really important, or something different? **B:** Just a bit important
		Neutral opinion about achievement	**Interviewer:** for you B, is being good at reading or at literacy, is that an important thing to you or not so important? **B:** I'm not bothered me.
	Value of success	Internally motivated to achieve	**B:** It [timed test] was proper good…because it's helping me like get better at words and that.

		success/goals	**B;** In these sheets (*pointing to words and sheets in front of him)* they're just like words and they're like, they don't really like matter…well they do but for your learning and that but like…[pause]… They <u>do</u> matter but they don't, they don't go into like our thingys for our levels and they're just like there to help me and that…
	Need for achievement	Externally motivated to achieve success/goals	**Interviewer:** are you saying that literacy - it's not that important, oh it's a bit important, or that it's really important, or something different? **B:** Just a bit important **Interviewer:** A bit important. And what makes it a little bit important? **B:** Because we do these tests for like levels and that and like…I need to get a good level.
	Fear of failure	Positive about avoiding failure	**Interviewer:** why do you need to get a good level B? **B:** So I can do something good with my life.
	Affect	Positive feelings as a result of change in learning	**Interviewer:** …what did you think when you saw what you'd got? **B:** [Pause] That I were doing good **Interviewer:** What did that [Precision teaching session] make you feel like? **B:** Erm……happy.

		No change in feelings towards literacy during PT	**Interviewer:** Did you notice any changes to what you were feeling about reading or was it just the same? **B:** Just the same
		External input providing encouragement	**Interviewer:** What did they [teaching staff] do to help you to read things? If I saw them helping you to read something, what would I see them doing? **B:** Encouraging me… "Come on you can do it" and all that.
		Positive feeling towards literacy	**Interviewer: …**is there anything you don't like in literacy? **B:** No
	Challenge	Positive presence of challenge	**B:** Erm……happy. Like we [Pupil A, B and C] were having this little contest thing. **Interviewer:** having a contest? **B:** Yeah seeing who could get the most...

8.23 Appendix 23 Pupil C thematic analysis full data

Theory of motivation	Overall theme	Sub-theme	Data example
Attribution theory	location of attribution	internal attribution for learning change	**C:** I got a bit quicker…and a bit neater **C:** then I have to write it in **C:** oh there I got muddled up (*Pointed to work sheet)* **Interviewer:** OK, so what did you do to make those changes to your handwriting, what did you do? **C:** Well…we wrote stories…practiced when I read and at home. **C:** Well joining up because I think at moment me doing joining up right would be not good because I still do need to work on my handwriting.
		external attribution for learning change	**Interviewer:** And can you tell me any more about that…why would it be alright if you were away from

			people talking in class? **C:** Because I won't get distracted **Interviewer:** Ok what was it like when there were other teachers there working at the same time? **C:** Get distracted a bit **C:** Well, Mrs H did this to make my handwriting quicker and neater. **Interviewer:** And what is this, what did they do? **C:** well, (*Indicates timed test probe sheets)* **C:** first they [Teaching Assistants] showed me what to write **Interviewer:** Did other people do anything to help you with those handwriting changes? Do you feel like other people whether that might be people in your class or other teachers… **C:** Oh yeah sometimes I did some handwriting with

			you *(referring to researcher)*. **C:** there were these (*Pointed at worksheets)* working on my handwriting.
		Unknown attribution for learning change	**Interviewer:** I wonder if you can tell me any more about why you think these changes happened? **C:** Well…[pause] I don't know. [pause]
	locus of control	Learning progress stability	**C:** I got a bit quicker…and a bit neater
		Learning progress instability	**C:** Well it looks more neater than the others…what's in the books and there and there *(pointing to different work sheets)*…and there…well there it gets a little bit done, but there I got a whole line done. **C:** At first I got 3 or 4 reds but then it went down a bit and then it went down a bit more, then down a bit more then it went up there, then down here, then up here, then down here.

			Interviewer: So what does it mean? What does it mean that green line? **C:** Well, it's getting better.
		Learning progress controlled by pupil factors	**C:** we wrote stories…practiced when I read and at home. **Interviewer:** So when you did practice at home, or when you were doing your handwriting in school, why did you do it? **C:** Well so that my handwriting's better.
Social learning theory	Value of goal	Social expectation of goal achievement	**Interviewer:** And why was that important? **C:** So that I write…so if I write the teacher can know what I'm writing
		Social focus of achieving goal	**Interviewer:** And why is it important for you to get a good mark? **C:** Well, cos if I've got the same marks as my friend and then we go to the same secondary school, then I

			might be in the same class as them. Right and why is that important to be in the same class as your friends? **C:** Well I just, just so you know where they are, and you can talk to them when you're going in or just before you're going in.
	Expectancy of goal occurring	Increase in literacy skills/success	writing, handwriting. I got a bit quicker…and a bit neater **C:** Well it looks more neater than the others…whats in the books and there and there *(pointing to different work sheets)*…and there…well there it gets a little bit done, but there I got a whole line done. **Interviewer:** So what does it mean? What does it mean that green line? **C:** Well, it's getting better.

		PT supported changes to literacy skills	**C:** there were these (*Pointed at worksheets)* working on my handwriting. **C:** Well it looks more neater than the others…whats in the books and there and there *(pointing to different work sheets)*…and there…well there it gets a little bit done, but there I got a whole line done. **Interviewer:** Yeah...? **C:** so I got a bit quicker…and a bit neater
Achievement theory	Hope of success	Increased probability of learning success	I got a bit quicker…and a bit neater.
		PT supported understanding of learning changes	**C:** Well…alright, like…my greens are high, there's loads of greens because my greens get high.. I haven't got that many reds. At first I got 3 or 4 reds but then it went down a bit and then it went down a bit more, then down a bit more then it went up there, then down here, then up her, then down here. **Interviewer:** So what does it mean? What does it

			mean that green line? **C:** Well, it's getting better. **Interviewer:** what did it feel like when you were doing the sessions and you were doing you handwriting and you saw at the end that your green line was going up. **C:** Well, it makes me feel good. **Interviewer:** Mmm, why did it make you feel good? **C:** Because it showed that my handwriting's getting better.
	Need for achievement	Positive about improvement	**Interviewer:** What made it kind of fun, coming across a new letter? **Interviewer:** So when you did practice at home, or when you were doing your handwriting in school, why did you do it? **C:** Well so that my handwriting's better.

			Interviewer: why did it make you feel good? **C:** Because it showed that my handwriting's getting better.
	Value of success	Internally motivated to achieve success/goals	**Interviewer:** What made it kind of fun, coming across a new letter? **C:** Well because so you know how to join it, and then you try to make it neater. **Interviewer:** What did it make you feel like doing that chart? **C:** Well…alright, like…my greens are high, there's loads of greens because my greens get high. **Interviewer:** When you were doing these teaching sessions, I'm wondering what it made you feel about your learning and your reading? **C:** It makes me feel happy. **Interviewer:** What about that makes you feel happy? **C:** Well because it makes you feel happy because I'm

			proud of myself. **Interviewer:** what did it feel like when you were doing the sessions and you were doing you handwriting and you saw at the end that your green line was going up. **C:** Well, it makes me feel good. **Interviewer:** Mmm, why did it make you feel good? **C:** Because it showed that my handwriting's getting better.
		Externally motivated to achieve success/goals	**Interviewer:** And why was that important? **C:** So that I write…so if I write the teacher can know what I'm writing. **Interviewer:**…why is that important? **C:** Because if she doesn't know what I'm writing, she won't know what I thingy…what I'm saying. **Interviewer:** why is it [literacy] important?

			C: So my teacher will know what I'm saying. **Interviewer:** why is that important, how come? **C:** Well because if the teacher doesn't know what I'm saying, well how does she know what I'm putting, and like if she, like in an exam to see like in a writing exam and I've got to write it down and she don't know what I'm saying cos it's not neat, I'll get done, I'll just get no marks.
	Avoidance of failure	Aware of preventing failure	**C:** I haven't got that many reds… **C:** Well because if the teacher doesn't know what I'm saying, well how does she know what I'm putting, and like if she, like in an exam to see like in a writing exam and I've got to write it down and she don't know what I'm saying cos it's not neat, I'll get done, I'll just get no marks.

			Interviewer:…if you got no marks what would happen? **C:** Well, I'd go down…
	Affect	Negative views of literacy	**Interviewer:** Are there any bits that you really don't like? **C:** Well, spelling tests…
		Positive affect towards literacy	**Interviewer:** do you like literacy, do you think it's ok… **C:** It's alright… **C:** I like different types of writing. **Interviewer:** When you were doing these teaching sessions, I'm wondering what it made you feel about your learning and your reading? **C:** It makes me feel happy. **Interviewer:** What about that makes you feel happy? **C:** Well because it makes you feel happy because I'm proud of myself.

		Positive affect towards PT	**Interviewer: …**and why was that fun to play with Mrs H? **C:** Because she were thinking of some difficult words…and she don't give me any clues. **Interviewer:** what did it feel like when you were doing the sessions and you were doing you handwriting and you saw at the end that your green line was going up. **C:** Well, it makes me feel good. **Interviewer:** Mmm, why did it make you feel good? **C:** Because it showed that my handwriting's getting better. **Interviewer:** What did it make you feel like doing that chart? **C:** Well…alright, like…my greens are high, there's loads of greens because my greens get high. **Interviewer:** Can you tell me any more about what they were like?

			C: Well they were fun because…I don't know why, but I just found them fun.
	Presence of challenge	Challenge present during sessions	**Interviewer:** Yeah, what was it like learning new letters or trying to make those letters even neater? What was that like? **C:** Er…a bit harder.

8.24 Appendix 24 Pupil D thematic analysis full data

Theory of motivation	Overall theme	Sub-theme	Data example
Attribution theory	location of attribution	internal attribution of learning change	**Interviewer:** what about the sessions did you need to concentrate on? **D:** So I can learn how to do stuff **Interviewer:** so why would you need to concentrate on your spelling **D:** To improve **Interviewer:** if I saw you concentrating, what would I see you doing? **D:** Working… **Interviewer:** And if you were needing to concentrate D, what would you be thinking? **D:** About my work **D:** I knew how to spell a lot of words. **Interviewer:** was there anything that made it easier? **D:** Erm learning the word.

			Interviewer: Ok and how did you learn that word? **D:** We used it over and over again
		external attribution of learning change	**Interviewer:** what was that like for it to be quiet while you were doing the sessions? **D:** Good **Interviewer:** Was it? Why was it good D? **D:** Cos there were no-one disturbing you **Interviewer:** And was there any particular reason why that's good, for you to not be disturbed? **D:** So I can concentrate **Interviewer:** what about the difficulty level staying the same made it better in those sessions? **D:** I made progress. **Interviewer:** What was Mrs Y like as a teacher? What did she do? **D:** Doesn't shout. **Interviewer:**...And what did you like about that she didn't shout?

			D: Learnt a lot. **Interviewer:** Why if a teacher doesn't shout do you learn more? **D:** Because you get to concentrate and you get to hear what they say. **Interviewer:** Ok, could anything have made it more exciting or better, or less boring? **D:** Read better words. **D:** and then I started doing that *(Precision Teaching sessions)* then she saw a change in my work.
		Rejecting external attribution for progress	**Interviewer:** Did Mrs Y do something to help those changes to happen? **D:** No. **Interviewer:** Mrs Y didn't do anything to make those changes happen. **D:** Well she organised it and that's about it.
		Rejecting internal attribution for progress	**Interviewer:** Ok, do you think that you did anything to make those changes happen with your spelling? **D:** No.

		unknown attribution	**D:** Every week we did so many words and then just got better at it.
	locus of control	Instability of learning progress	**D:** I weren't that good back in primary **D:** Cos when I were with the rest of the class doing my spelling test we normally did 30 and the best I did I got 15, and everybody else were getting in 20s. **Interviewer:**...so what was helpful about the PT sessions? **D:** Helped me to spell and helped me to get higher grades. **Interviewer:** what about the difficulty level staying the same made it better in those sessions? **D:** I made progress. **Interviewer:** What about those activities made you feel confident? **D:** Because I knew how to spell a lot of words. **Interviewer:** Ok and how did you learn that word? **D:** We used it over and over again **D:** when I did spelling tests she *(Mrs Y)* always used to mark me work and then

			I didn't used to get a lot and then I started doing that *(Precision Teaching sessions)* then she saw a change in my work.
		Learning progress controlled by pupil	**Interviewer:** so why would you need to concentrate on your spelling **D:** To improve **D:** Cos when I were with the rest of the class doing my spelling test we normally did 30 and the best I did I got 15, and everybody else were getting in 20s. **Interviewer:**...so what was helpful about the PT sessions? **D:** Helped me to spell and helped me to get higher grades. **Interviewer:** If I saw you concentrating, what would I see you doing? **D:** Working. **Interviewer:** And how did you learn how to spell? **D:** Learnt words… **Interviewer:** Ok. But how? What did you do to learn how to spell, what were you doing that was different? **D:** Every week we did so many words and then just got better at it.

		Learning progress not controlled by pupil	**Interviewer:** What was Mrs Y like as a teacher? What did she do? **D:** Doesn't shout. **Interviewer:**...And what did you like about that she didn't shout? **D:** Learnt a lot. **Interviewer:** what about the difficulty level staying the same made it better in those sessions? **D:** I made progress. **Interviewer:** Why if a teacher doesn't shout do you learn more? **D:** Because you get to concentrate and you get to hear what they say. **Interviewer:** Ok, do you think that you did anything to make those changes happen with your spelling? **D:** No.
	Social comparison	Comparison with peers'	**D:** Cos when I were with the rest of the class doing my spelling test we normally did 30 and the best I did I got 15, and everybody else were getting in 20s.

		skill level	**D:** Highest I ever got was 30 in 2 minutes… no 35, with none wrong! **Interviewer:** mmm wow! What did that make you feel like? **D:** Happy. **Interviewer:**... Why would that make you feel happy? **D:** Cos I got the score what they were doing in class. **Interviewer:** why would it feel bad not to be learning something? **D:** Because I'll be behind all the time.
	Perceived learning changes	Change in task competence	**D:** Just felt confident about spelling **Interviewer:** What about those activities made you feel confident? **D:** Because I knew how to spell a lot of words. **Interviewer:** What changes did you notice? **D:** That I could spell. **D:** when I'm writing stuff in my planner now I can spell it.

			D: Every week we did so many words and then just got better at it.
Social learning theory	Value of goal	Individual value of literacy	**Interviewer:** And is being good at literacy important for you? **D:** Yeah **Interviewer:** mmm, how come? **D:** Because literacy is probably one of the most important subjects.
		Social value of achieving goal	**Interviewer:** why would it feel bad not to be learning something? **D:** Because I'll be behind all the time. **Interviewer:**...so what was helpful about the PT sessions? **D:** Helped me to spell and helped me to get higher grades.

	Expectancy of progress	Increase in skills/success	**Interviewer:** What about those activities made you feel confident? **D:** Because I knew how to spell a lot of words. **D:** when I'm writing stuff in my planner now I can spell it. **D:** No she [Mrs Y] saw a change in my work **Interviewer:** Mmm right she saw a change in your work. What change did she see? **D:** Writing **D:** Cos when I were with the rest of the class doing my spelling test we normally did 30 and the best I did I got 15, and everybody else were getting in 20s. **Interviewer:**...so what was helpful about the PT sessions? **D:** Helped me to spell and helped me to get higher grades. **Interviewer:** what about the difficulty level staying the same made it better in those sessions? **D:** I made progress. **D:** Highest I ever got was 30 in 2 minutes… no 35, with none wrong!

Achievement theory	Hope of success	Positive about making improvement	**Interviewer:** why did it make you feel happy D? **D:** Because you learnt summat **D:** Highest I ever got was 30 in 2 minutes… no 35, with none wrong! **Interviewer:** mmm wow! What did that make you feel like? **D:** Happy. **Interviewer:** what did it made you feel inside about your learning D? **D:** Good… Because I was learning summat.

		PT supported awareness of learning change	**Interviewer:** How could you tell that you were making progress D? **D:** On that sheet I got 28 in 2 minutes, and then I got 24…I went down a bit. Then I went back up and then I went across a bit *(referring to chart).*
		PT increased probability of learning change	**D:** Cos when I were with the rest of the class doing my spelling test we normally did 30 and the best I did I got 15, and everybody else were getting in 20s. **Interviewer:**...so what was helpful about the PT sessions? **D:** Helped me to spell and helped me to get higher grades. **Interviewer:** What about those activities made you feel confident? **D:** Because I knew how to spell a lot of words. **D:** and then I started doing that *(Precision Teaching sessions)* then she *(Mrs Y)* saw a change in my work.
	Intrinsic need for achievement	positive opinion of literacy	Ok, you made progress. What did it make you feel like? **D:** Happy

		progress	**Interviewer:** why did it make you feel happy D? **D:** Because you learnt summat **Interviewer:** what did it made you feel inside about your learning D? **D:** Good… Because I was learning summat.
	Value of success	Internally motivated to achieve literacy goals	**Interviewer:** so why would you need to concentrate on your spelling **D:** To improve **Interviewer:** why did it make you feel happy D? **D:** Because you learnt summat **Interviewer:** what did it made you feel inside about your learning D? **D:** Good… Because I was learning summat.
	Avoiding failure	anxiety about failure	**Interviewer:** why would it feel bad not to be learning something? **D:** Because I'll be behind all the time.
	Affect	Negative affect about PT session	**D:** Got bored.

		Positive feelings as a result of learning progress	Ok, you made progress. What did it make you feel like? **D:** Happy **D:** Highest I ever got was 30 in 2 minutes… no 35, with none wrong! **Interviewer:** mmm wow! What did that make you feel like? **D:** Happy. **Interviewer:** what did it made you feel inside about your learning D? **D:** Good
		Positive feeling about PT	**Interviewer:** Alright, so how did you find doing the PT sessions, what were they like? **D:** Helpful [Pause] Good. **Interviewer:** Did they *(PT session activities)* make you feel good, bad, in the middle? **D:** Good **Interviewer:** Can you tell me any more about why. **D:** Just felt confident about spelling

	Challenge	Positive presence of challenge	**Interviewer:** what about the difficulty level staying the same made it better in those sessions? **D:** I made progress. **Interviewer:** How did it feel when you came across a word you didn't know how to spell? **D:** Good. **Interviewer:**…Ok, why did it feel good? **D:** Because I wanted a challenge. **Interviewer:** Ok, could anything have made it more exciting or better, or less boring? **D:** Read better words. **Interviewer:** …What kind of words would have been better? **D:** Harder words to spell
		Negative presence of	**Interviewer:** what about it (*class spelling test)* being longer made it worse? **D:** Because higher the number you got, the harder the word got so…

		challenge	
		Presence of challenge in session activities	**Interviewer:** Ok so what was different about the words in the session? **D:** It just stayed the same. **Interviewer:** It just stayed the same. What stayed the same D? **D:** The difficulty. **Interviewer:** …What was it like when you came across a word that you didn't know how to spell? **D:** Difficult
		Insufficient challenge producing negative affect	**D:** Because I know quite a lot of the words we were doing, and it got a bit boring after a while doing the same words. **Interviewer:** Ok, could anything have made it more exciting or better, or less boring? **D:** Read better words. **Interviewer:** …What kind of words would have been better? **D:** Harder words to spell

8.25 Appendix 25 Thematic analysis procedure

List of combined themes and codes for Pupils A, B, C and D

Theory of motivation/ Theme	Sub-theme	Code
Attribution theory	location of attribution	Internal attribution of learning change
		External attribution of learning change
		Rejecting external attribution for progress made
		Rejecting internal attribution for progress made
		Unknown attribution for learning outcomes
	locus of control	Increase in learning success stability
		Literacy progress stability
		Instability of learning progress
		Learning progress stability
		Element of pupil control over learning progress
		Element of uncontrollability over learning

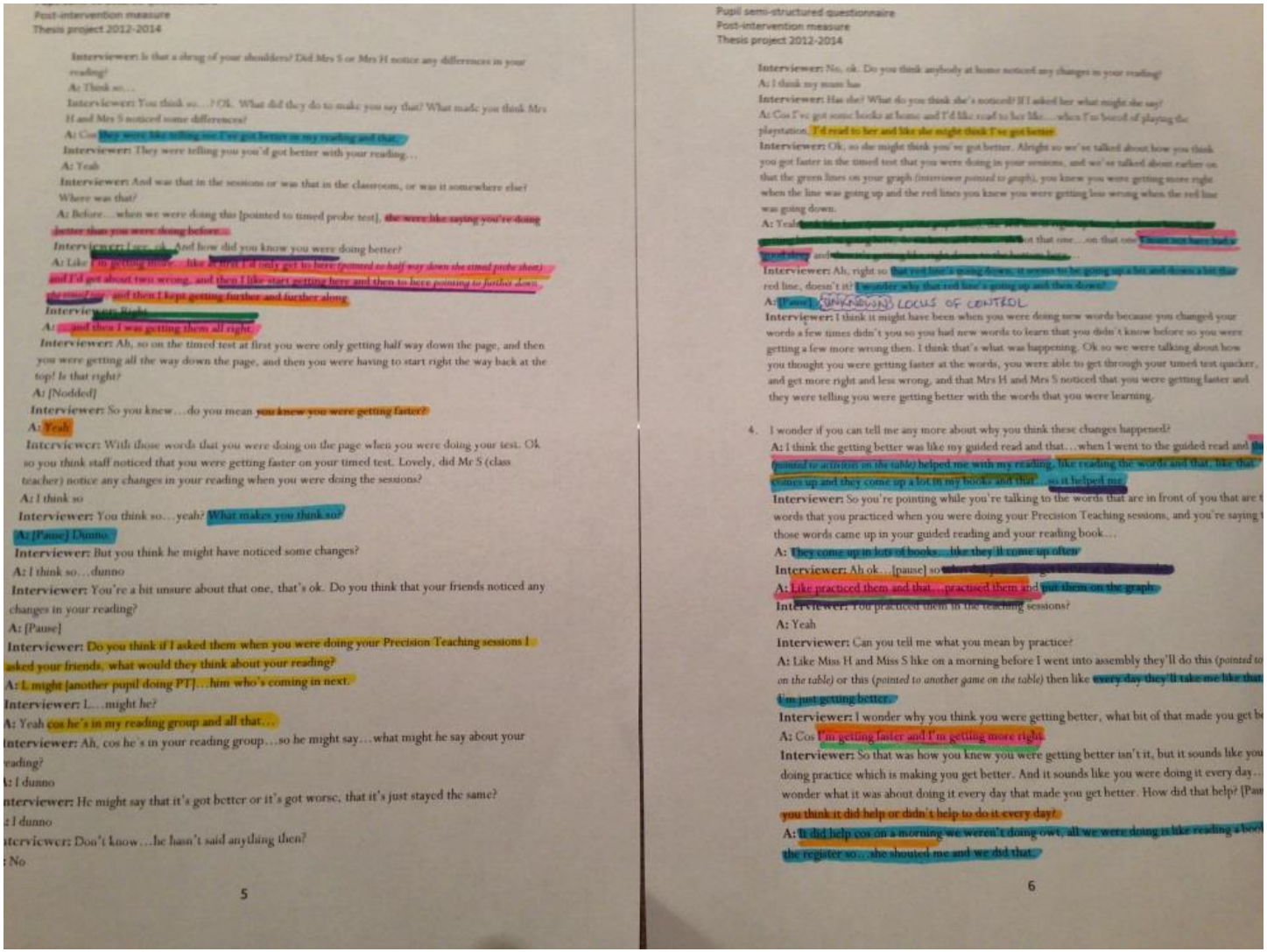
		progress
	Level of competence in task	Change in task competence
		Increased competence
		PT supporting awareness of competence
	Social comparison	Comparison with peers' skill level
		Others noticing learning changes
		Social expectation of goal achievement
		Social focus for achieving goal
	Self-perception as a learner	Increased task competence
	Attributing affect	Negative affect

		Positive feelings as a result of changes in learning
		No change in feelings towards literacy during PT
		External input impacting affect
		Positive feelings towards literacy
		Positive feelings about PT
	Attributions around challenge	Positive presence of challenge
		Negative presence of challenge
		Presence of challenge in session activities
Social learning theory	Value of goal	Individual value of literacy
		Social value of achieving literacy goal

		Future focus for achieving goal
		Limited value of literacy
		Value of literacy skills as distinct from tests
	Locus of control	Internal - within pupil factors as cause of change
		External - environmental factors as cause of change
	Expectancy of goal occurring	Increase in skills/success
		Practice of literacy skills
		Unknown level of skill change
		Decrease in success
Achievement theory	Intrinsic need for achievement	Positive opinion of achievement
		Neutral opinion of achievement
	Hope of success	Positive about literacy improvement made
		Increased probability of learning success

		PT supported awareness of learning change
		PT increased probability of learning change
	Need for achievement	External motivation to achieve success/goals
	Value of success	Internal motivation to achieve success/goals
	Avoidance of failure	Positive about avoiding failure
		Aware of preventing failure
		Anxiety about failure
	Affect	Negative feelings towards literacy
		Negative affect about PT session
		Positive feelings as a result of learning progress
		No change in feelings towards literacy during PT
		External input providing encouragement

		Positive feelings towards literacy
		Positive affect towards PT
	Presence of challenge	Challenge as negative
		Presence of challenge in session activities
		Insufficient challenge producing negative affect
		PT monitoring produced challenge



Post-intervention measure
Thesis project 2012-2014

Interviewer: Is that a shrug of your shoulders? Did Mrs S or Mrs H notice any differences in your reading?
A: Think so…
Interviewer: You think so…? Ok. What did they do to make you say that? What made you think Mrs H and Mrs S noticed some differences?
A: Cos they were like telling me I've got better on my reading and that.
Interviewer: They were telling you you'd got better with your reading…
A: Yeah
Interviewer: And was that in the sessions or was that in the classroom, or was it somewhere else? Where was that?
A: Before…when we were doing this [pointed to timed probe test], she were like saying you're doing better than you were doing before…
Interviewer: I see, ok. And how did you know you were doing better?
A: Like I'm getting more… like at first I'd only get to here *(pointed to half way down the timed probe sheet)* and I'd get about two wrong, and then I like start getting here and then to here *pointing to further down the timed test* and then I kept getting further and further along.
Interviewer: Right.
A: …and then I was getting them all right.
Interviewer: Ah, so on the timed test at first you were only getting half way down the page, and then you were getting all the way down the page, and then you were having to start right the way back at the top! Is that right?
A: *[Nodded]*
Interviewer: So you knew…do you mean you knew you were getting faster?
A: Yeah
Interviewer: With those words that you were doing on the page when you were doing your test. Ok so you think staff noticed that you were getting faster on your timed test. Lovely, did Mr S (class teacher) notice any changes in your reading when you were doing the sessions?
A: I think so
Interviewer: You think so…yeah? What makes you think so?
A: *[Pause]* Dunno.
Interviewer: But you think he might have noticed some changes?
A: I think so…dunno
Interviewer: You're a bit unsure about that one, that's ok. Do you think that your friends noticed any changes in your reading?
A: *[Pause]*
Interviewer: Do you think if I asked them when you were doing your Precision Teaching sessions I asked your friends, what would they think about your reading?
A: I might [another pupil doing PT]…him who's coming in next.
Interviewer: I…might he?
A: Yeah cos he's in my reading group and all that…
Interviewer: Ah, cos he's in your reading group…so he might say…what might he say about your reading?
A: I dunno
Interviewer: He might say that it's got better or it's got worse, that it's just stayed the same?
A: I dunno
Interviewer: Don't know…he hasn't said anything then?
A: No

Pupil semi-structured questionnaire
Post-intervention measure
Thesis project 2012-2014

Interviewer: No, ok. Do you think anybody at home noticed any changes in your reading?
A: I think my mum has
Interviewer: Has she? What do you think she's noticed? If I asked her what might she say?
A: Cos I've got some books at home and I'd like read to her like…when I'm bored of playing the playstation, I'd read to her and like she might think I've got better.
Interviewer: Ok, so she might think you've got better. Alright so we've talked about how you think you got faster in the timed test that you were doing in your sessions, and we've talked about earlier on that the green lines on your graph *(interviewer pointed to graph)*, you knew you were getting more right when the line was going up and the red lines you knew you were getting less wrong when the red line was going down.
A: Yeah
Interviewer: Ah, right so that red line's going down, it seems to be going up a bit and down a bit that red line, doesn't it? I wonder why that red line's going up and then down?
A: [Pause] (UNKNOWN) LOCUS OF CONTROL
Interviewer: I think it might have been when you were doing new words because you changed your words a few times didn't you so you had new words to learn that you didn't know before so you were getting a few more wrong then. I think that's what was happening. Ok so we were talking about how you thought you were getting faster at the words, you were able to get through your timed test quicker, and get more right and less wrong, and that Mrs H and Mrs S noticed that you were getting faster and they were telling you were getting better with the words that you were learning.

4. I wonder if you can tell me any more about why you think these changes happened?
A: I think the getting better was like my guided read and that…when I went to the guided read and the *(pointed to activities on the table)* helped me with my reading, like reading the words and that, like that comes up and they come up a lot in my books and that…so it helped me.
Interviewer: So you're pointing while you're talking to the words that are in front of you that are t words that you practiced when you were doing your Precision Teaching sessions, and you're saying those words came up in your guided reading and your reading book…
A: They come up in lots of books…like they'll come up often.
Interviewer: Ah ok…[pause] so
A: Like practiced them and that…practised them and put them on the graph.
Interviewer: You practiced them in the teaching sessions?
A: Yeah
Interviewer: Can you tell me what you mean by practice?
A: Like Miss H and Miss S like on a morning before I went into assembly they'll do this *(pointed to on the table)* or this *(pointed to another game on the table)* then like every day they'll take me like that I am just getting better.
Interviewer: I wonder why you think you were getting better, what bit of that made you get b
A: Cos I'm getting faster and I'm getting more right.
Interviewer: So that was how you knew you were getting better isn't it, but it sounds like you doing practice which is making you get better. And it sounds like you were doing it every day… wonder what it was about doing it every day that made you get better. How did that help? [Pau you think it did help or didn't help to do it every day?
A: It did help cos on a morning we weren't doing owt, all we were doing is like reading a boo the register so…she shouted me and we did that.

Pupil semi-structured questionnaire
Post-intervention measure
Thesis project 2012-2014

B: A little bit
Interviewer: A little bit, which bits did you fill in then, do you remember?
B: Erm I filled in this bit *(points to points on graph)* and filled up all the light green,
Interviewer: Did you? Ah so you did all the light green bits, ah I see.
B: coz there were like numbers on there so…
Interviewer: Right so there are numbers on the side so…
B: Yeah so it would tell me where I'd got to
Interviewer: Ah it told you what you'd got…on what?
B: On the graph
Interviewer: Ah it told you what you'd got on the graph, alright, so you could see what you'd got. And what was it like seeing what you'd got,
B: [Pause]
Interviewer: Ok. And the last little bit on this questions, when you were round that corner, what was it like in terms of the classroom…who was there and what was it like working in that area of the classroom?
B: Erm…well that was like a quiet bit so it were alright.
Interviewer: Ah ok, that was the quiet bit so it was alright?
B: Yeah
Interviewer: What made it alright about it being quiet?
B: You can just concentrate more
Interviewer: Ah right you can concentrate more, ok.

graph supported knowledge of competence

3. **The next thing I wanted to ask about was whether you noticed any changes in your reading during the Precision Teaching sessions.**

B:
Interviewer: You were getting more things right?
B: Yeah
Interviewer: Where?
B: In like my reading tests and all that cos I've been reading them and all that, and it helped me with my reading so…
Interviewer: Right so you were getting more right on your reading tests because you were reading the words more…ok. Do you think Mrs H and Mrs S noticed any differences?
B: Don't know
Interviewer: Did they say anything that made you think they'd noticed any changes?
B: Erm no
Interviewer: Ok, did Mr S notice any changes do you think in your reading?
B: Don't know cos he don't like tell us the answers or owt so…
Interviewer: Ok, he doesn't tell you the answers, alright. Did any other members of staff speak to you about it or talk to you about any changes in your reading?
B: No
Interviewer: No? Ok. Do you think that your friends would have noticed any changes in your reading when you were doing the teaching sessions?
B: mmm…no….dunno.
Interviewer: No? If I asked Mrs S or I asked a friend, what do you think they would say about your reading when you were doing the teaching sessions?
B: I don't know…

Information for inter-raters:

Attribution theory: “one wants to know why an event has occurred, and to what source, motive or state it may be ascribed” (Weiner, p.229)

Internal attribution: attribute learning success to internal (within pupil) factors. These could include the pupil’s own behaviour, personal characteristics/attitudes to learning

External attribution: pupil attributes changes to their learning to factors external to themselves. Examples of this could be factors within the school or home environment, other peers or adults, luck or chance.

Unknown attribution: the pupil reports not knowing a reason for a change in their learning.

Controllable: This factor stated by the pupil is under the control of the pupil

Uncontrollable: This factor is under the control of someone other than the pupil

Stable: This factor is perceived by the pupil as a factor that will stay the same and is immovable/unchangeable

Unstable: This factor may alter and is changeable and is perceived as this by the pupil

Social comparison: comparisons with peers/similar others impacting motivation towards learning

Affect: positive or negative feelings about Precision Teaching

8.26 Appendix 26 Literature review Weight of Evidence review

Table to show the application of Weight of Evidence model in reviewing inclusion of research in the systematic review. In making this decision, consultation of the abstract was completed alongside consultation of the full paper where the abstract did not provide sufficient details.

Title of research paper	Setting	Participants	Use of intervention	Methodology	Outcomes of research	Weight of Evidence
Bradfield, R. H., Brown, J., Kaplan, P., Rickert, E., & Stannard, R. (1973). The special child in the regular classroom. Exceptional children, 39(5), 384-390.	3rd and fourth grade classrooms. Integration from separate 'remedial' education classes to being included in mainstream classes. USA	3 children with what is referred to in the paper as "mental retardation" previously placed in special separated education classes.	This study used Precision Teaching to monitor the progress of the 3 participants and create an individualised programme of intervention.	Control and comparison group.	Academic skills, social behaviour and attitude change were shown to have made a significant improvement beyond that of control participants.	A: Use of control and experimental groups strengthens methodological quality as does continuation of the intervention over 2 grades. B: Although experimental methodology increases reliability

						and validity of the information gathered, this study is exploratory and therefore potentially requires a more mixed methods approach to investigate the social/attitudinal changes of participants. C: The focus of this research was on integration of the 3 students within mainstream education, not on attitudes of the

						participants towards their learning. D: This research has a different focus than the question posed in the systematic review. Excluded
Brandstetter, G., & Merz, C. (1978). Charting Scores in Precision Teaching for Skill Acquisition.	14 children in 4th Grade. Examined the practice of charting scores in precision teaching for skill	14 participants. These were children who were in 4th grade mainstream classrooms with reading	Two studies are documented in this paper. In each study each participant received 2 treatments for two weeks, linear/semi-log	Pre-test performance Post-test comparison of average change in performance scores.	Performances increased in first study, with gains more pronounced whilst charting using linear graph than recording raw scores. In second study,	A: pre-test/ post-test comparison used but experimental condition changed within participants during the study. Only used 14 participants and

	acquisition in reading, using as Ss. USA	levels 1.5-2.5 yrs below grade level	graph and recording raw scores. 1. Comparison of recording daily scores on linear graph with recording raw scores 2. Comparison of recording daily scores using a semi-log chart with recording the raw scores.		no significant differences in performance between charting on semi-log graph and recording raw scores.	therefore limited statistical significance can be drawn from fixed design methodology. B: This methodology reviews how the graphs used in PT impact on performance. C: Focus on impact on performance but no focus on affective factors of this on further learning.

						D: Although this research reviews PT, its methodological weaknesses limit the strength of its evidence. Excluded
Brooks, P. (1995). A comparison of the effectiveness of different teaching strategies in teaching spelling to a student with severe specific difficulties/dyslexia.	Individual teaching using Precision Teaching methods to teach and test performance. UK	1 male participant, aged 11 years and 10 months with a specific learning difficulty and dyslexia. Reading age	Precision Teaching framework used to systematically teach and test the participant on word spelling and reading.	Single case experimental design study. Changing criterion design.	Participant performance showed most improvement when using the "words in words" approach. Application of structure to teaching and	A: Changing criterion design within a SCED completed in accordance with methodological standards. B: SCED methodology to

		of 7 years and 6 months, spelling age 7 years 5 months.			performance monitoring did not support participant to retain and recall spellings.	review the effects of PT on learning attainment of a single participant appears appropriate for the focus of the research. C: This research study focusses on the effects of PT on performance within a SCED. D: This paper is relevant to the systematic review research question. Included

Title of research paper	Setting	Participants	Use of intervention	Methodology	Outcomes of research	Weight of Evidence
Chapman, S. S., Ewing, C. B., & Mozzoni, M. P. (2005). Precision teaching and fluency training across cognitive, physical, and academic tasks in children with traumatic brain injury: a multiple baseline study.	6 participants who had received a traumatic brain injury. They were at different periods in their recovery, post-acute residential neuro-rehabilitation unit. USA	Participants had no prior medical conditions other than those stated. Participants were aged between 11 and 19 years old.	Precision Teaching was used to monitor progress on differing aims for each participant. These were multiplication sums, increasing speed of motor skills, answering autobiographical questions, and learning sign language words.	Single-case experimental design, multiple baselines.	All five participants indicated increases in fluency of the skill they had received teaching on.	A: Multiple baseline SCED undertaken with attempts to increase reliability and validity of results. B: SCED appropriate for the needs of participants and research aims. C: PT was being used for some cases for academic purposes but not strictly literacy. This

						study is not directly relevant to the research topic of the literature review. D: This study does not contribute evidence regarding the impact of PT on a typical population or on literacy skills. Excluded
Haring, N. G., & Krug, D. A. (1975). Evaluation of a program of systematic instructional procedures for extremely poor	Children with low IQ scores placed into four classes, 2 classes were taught using Precision	54 school age participants.	Precision Teaching methods were used to teach all areas of the curriculum.	Post-test comparison group.	60% of students taught using PT were shown to learn and retain basic skills which were needed to be educated in	A: Students were not tested on the same measures pre and post-test. Participants were matched on age, IQ score, socio-

retarded children.	Teaching methods, the other two were taught using typical teaching methods.				mainstream classes.	economic status and academic achievement. B: Although the methodology is experimental and a fixed design, it focuses on group effects rather than single cases. C: The focus of this study is on academic progress across curriculum areas rather than just literacy. D: This study does

						not comment on the affective elements of PT and has methodological inaccuracies. Excluded
Title of research paper	Setting	Participants	Use of intervention	Methodology	Outcomes of research	Weight of Evidence
Douglass, S., & Mangold, S. (1975). Precision Teaching of Visually Impaired Students.		2 participants, school age. USA	Precision Teaching was used to monitor progress in teaching participants the braille alphabet.	Case study	The precision teaching graph could be modified successfully to make it accessible to participants. Progress was made by participants.	A: Case study used to investigate wide-ranging factors for participants. B: Case study methodology works well alongside SCED design of review research question.

						C: The focus of the research was on how PT could support learning for children with a visual impairment. This population is not the focus of the current review. D: This study does not contribute relevant information to the current review. Excluded
Clouse (2010). Precision Teaching techniques for students with and	9 participants attended the same school (2nd-4th	9 participants, in second, third and	Precision Teaching was used to monitor reading fluency	SCEDs Students, parents and	The result indicated that single sigh word reading	A: Case studies used to investigate highly individual processes such as

without a traumatic brain injury (TBI).	grade) where they received specialist reading intervention alongside systematic instruction. USA	fourth grade. Three of these participants had sustained a traumatic brain injury.	of the participants.	staff were asked to give information on their perceptions of reading. Reading progress and self-esteem measures were used.	attainment increased alongside interest in reading and feelings about themselves as readers for participants without TBI. For participants with TBI their reading skills increased at a similar rate to non-TBI students. For two of the three TBI participants, reading interest did not increase.	self-esteem are valid. B: The methodology used in this study is relevant to the review research question. C: The focus of the research is on the affective factors of PT alongside the learning progress. D: This research study explores the affective elements of PT but does so

						in a non-typical population which is not relevant to the current study. Excluded
Title of research paper	Setting	Participants	Use of intervention	Methodology	Outcomes of research	Weight of Evidence
Downer A. C. (2007). The National Literacy Strategy Sight Recognition Programme Implemented by Teaching Assistants: A precision teaching approach.	Participants attended infants, junior and secondary schools. UK	47 participants in Year 1-Year 8.	Each participant received a daily 4 minute Precision Teaching session based on sight word recognition (reading). Participants received between 2 and 22 weeks of	Pre and post-test - Salford Reading Scale. Comparison of performance changes within each school age range (i.e. infants,	Staff anecdotally reported that boys had made most progress and had shown largest attitude change towards literacy. Increases in word recognition performance was observed across participants.	A: Qualitative and quantitative data gathered but not a clear methodology. B: This study provided anecdotal feedback which is of interest to this literature review. C: Although the research set out to

			intervention.	juniors and secondary schools) Anecdotal feedback of PT experiences from staff and pupils.		address how PT could support literacy skills, the outcomes include comment on boys' and literacy learning, and the affective results of PT. This is therefore of relevance to the current literature review. D: This research is of relevance to the current literature review. Included

Roberts, W. & Norwich, B. (2010). Using precision teaching to enhance the word reading skills and academic self-concept of secondary school students: a role for professional educational psychologists.	Individual daily teaching sessions. Secondary schools UK.	Participants were 77 secondary school students and 16 Teaching Assistants.	Each participant received daily Precision Teaching sessions on	Quasi-experimental Random allocation to experimental and wait-list control groups. Word reading skills and academic self-concept measured.	Although there were not significant results gained between PT and teaching as usual control groups, there was a significant difference in the gains which continued after the intervention had finished. The authors hypothesise that increased confidence and self-efficacy (Bandura & Locke, 2003) may	A: The usual teaching methods differed between schools, therefore producing difficulty in isolating the independent effects of PT. B: This paper aimed to make comparisons between the academic self-concept of control and experimental phases, the methodology was therefore relevant.

					have enabled pupils to access learning more successfully in other curriculum areas.	C: This research is relevant to the current literature review due to its focus on PT, literacy outcomes and affective outcomes. D: This study provides relevant contributions to the literature review. Included
Title of research paper	Setting	Participants	Use of intervention	Methodology	Outcomes of research	Weight of Evidence
Dubrule, M. N. (1985) The study of precision teaching as a remedial method.		120 “special education students” 180 “regular	This study wanted to review the effects of	Experimental fixed design, pre and post measures.	For both “special education” and “regular education”	A: Quality of methodology used within this study was high.

		education students".	different frequency rates on progress within Precision Teaching programs. Within the "special education" group, 60 received PT. Within the "regular education" group, 990 received PT.	Attainment in basic skills were measured through PT alongside self-concept and anxiety measures pre-test and at a post 1 and post 2 period. Control groups of both "special education" students and "regular education"	experimental groups, there was a positive impact on learning progress over control groups. Self-concept and anxiety were not significantly different between experimental and control groups.	B: Comparison of groups does not allow 'why' information to be extracted from data. C: The focus of this study reviewed affective factors of the PT programme. D: This study is relevant to this literature review. Included

				students were present.		
Heath and Smith, 2009. Improving oral reading fluency in elementary students of American Indian heritage with learning disabilities using the repeated readings method.	Precision Teaching was implemented in an elementary private school. USA	Participants were three school age pupils and their teacher. All participants were of American-Indian heritage. Participants had identified difficulties with oral reading.	Precision Teaching was used to monitor progress during daily repeated readings practice.	Single subject research design used.	Slight improvement in oral fluency for all three participants.	A: Single case study design used, researcher indicated this could be useful for research completed with other pupils of the same population. B: Single case study designs are relevant methodologies for answering the systematic review question.

						C: This research is focused only on increasing attainment, no affective factors are measured. D: This study is not relevant to this literature review. Excluded
Fitzpatrick, McLaughlin and Weber (2004). The Effects of a First Day and Second Day Reads on Reading Accuracy with Reading Mastery III Textbook B	Precision Teaching took place in an elementary school, in the small resource base room	1 participant, 10 years old. 1 Teaching Assistant	50 minute sessions of spelling, writing and reading completed 3-4 times each week for 6	Single case experimental design, ABC phases.	Improvement in words read correctly between first and second day reading activities.	A: No return to baseline and erratic attendance of participant made single case results limited.

for a Fifth Grade Student with Learning Disabilities	with a Teaching Assistant. USA		weeks.			B: Single case design methodology was relevant to the purposes of this study. C: No consideration of affective impact of PT. D: Methodological issues result in exclusion from current literature review. Excluded
*Ivarie (1986). Effects of proficiency rates on later	This study took place in a number of	120 participants in fourth	Three days of Precision Teaching	ANCOVA and t-tests were used to	Participants in the average and low groups performed	A: As an experimental fixed designs study, the

performance of a recall and writing behaviour.	schools with students in the fourth grade.	grade. Participants were separated into group as categorised by low, average and high curriculum attainment. USA.	treatment including detailed instruction was given to participants.	compare the percentage of correct responses and retention. Post-tests were conducted each month for four months.	significantly better when a higher fluency/accuracy rate was required.	separation of participants into groups and comparison of group means fits the purposes of the study. However there was no comparison group. B: Comparing group norms is highly relevant to the current literature review. C: This study reviews how well PT works for pupils of differing ability

						with no consideration of affective outcomes. D: This research is not relevant to be included in the literature review. Excluded
Kessissoglou, S. & Farrell, P. (1995). Whatever happened to precision teaching?	This study took place in an inner city primary school. UK	12 year 5 and 6 pupils identified as having poor literacy performance (2 years behind chronological age)	Pupils randomly assigned to 1 of 3 groups. One of these groups received PT, one general reading activities, one control group.	Experimental study with presence of control group.	Anecdotal suggestions of raised confidence of participants in the experimental PT group towards reading comprehension. Neale Analysis of Reading scores improved for	A: There were a small number of participants limiting the significance of findings and ability to generalise? Limited information of significance of progress made in different groups.

					experimental group. Word reading improved in experimental group.	B: Qualitative results could contribute some information to the literature review. C: The study had some reference to affective outcomes of PT. D: This study should be included in the literature review. Included.
*Malanga, P. (2003) Using Repeated Readings and Error Correction to Build	Elementary school. USA. An analysis of	students at risk for academic failure.	Precision Teaching used to monitor changes in	A-B SCEDs	This study reported substantial improvements in	A: No second baseline phase therefore limited as to the significance

Reading Fluency with At Risk Elementary Students.	celerations.		correct word reading within an orally read passage.		reading fluency for all three participants.	of PT impact on results. Measuring repeated reading and correction procedure rather than PT. B: The single case study design is relevant to the literature review question. C: The focus of this study is on the teaching process rather than the PT monitoring and no consideration is given to the

						affective outcomes. D: This study is not relevant for inclusion in the literature review. Excluded
*Mangold, S (1978). The effects of a developmental teaching approach on tactile perception and braille letter recognition based on a model of precision teaching	Unable to locate					Unable to locate the full document Excluded
Morgan, P. L., & Sideridis, G. D. (2006). Contrasting the Effectiveness of	30 single-case studies were analysed, each with	107 single case study participants, each within	Fluency programmes used for a variety of	Single-case experimental designs.	Goal setting contributed most strongly to positive	A: Meta-analysis appears to be completed with due reference to issues

Fluency Interventions for Students with or At Risk for Learning Disabilities: A Multilevel Random Coefficient Modelling Meta-Analysis.	interventions aiming for fluency. USA	school age.	academic skills.		outcomes.	of validity and reliability. B: A meta-analysis appears to meet the purposes of the researchers. C: This meta-analysis does not specifically focus on Precision Teaching, and the components of PT can be categorised into a number of the categories used within the meta-analysis.

						D: For the above reason, the study does not meet the exclusion/inclusion criteria. Excluded.
*Moseley (1987). Words you want to learn.	Unable to locate					Information from abstract provided limited detail. Was not able to retrieve the full document. Excluded
*Patrizia, Cuzzocrea, Larcan (2008). Improving autonomy in mentally retarded children by precision teaching method.	Unable to locate					Can only access reference as not published. Therefore this cannot be used within the literature review. Excluded

*Pelletiere, M. (2003). An examination of the effects of fluency training on retention, distractibility, and generativity	The purpose of the present research was to evaluate the effects of training using an accuracy criterion alone versus accuracy and rate criteria on retention, distractibility, and generalisation.	Participants unclear from consulting the abstract.	The first study trained participants in component skills to differing levels of fluency. Retention of these skills was then measured alongside the ability of participants to generalise these skills to more complex tasks. The second study trained participants to accuracy alone	Methodology unclear from abstract.	The results suggest that fluency training does not produce superior performance in retaining, generalising or resisting distraction.	Can only access dissertation abstract as not published. Limited information available and this therefore cannot be used within the literature review. Excluded

			criteria.			
Selfridge & Kostewicz (2011). Reading Interventions for four students with learning difficulties.	Elementary school USA	4 third grade students	Received PT daily after a daily reading session for 10 weeks. 3 of the participants focussed on word reading, and one on sounds.	Case studies	Adaptations were made to the instructional programmes to meet the participant needs. 3 participants made progress in reading fluency.	A: This case study provides some but not comprehensive information about the participants, therefore limiting the validity of conclusions. B: The research design was appropriate for the small number of participants within the school context of the researcher.

						C: The case study focussed on the mechanisms by which Precision Teaching could support learning and therefore was relevant to the research question. D: This research was found to be relevant to the literature review. Included
Sharpley and Rowland (1986). Palliative verses direct action stress-reduction procedures as	Elementary school, USA.	50 elementary school children	Pupils had daily reading probes for accuracy, fluency and comprehension.	Multiple time-series design Pupils placed into one of five group	Significant improvement of reading skills shown only in remedial teaching	A: This time series experimental design provided appropriate measures to meet

treatments for reading disability.				conditions, one of which was remedial teaching with Precision Teaching monitoring. Pre and post-test assessment of reading skill was completed using standardised assessment.	group.	the methodological quality factors. B: The study design promoted the use of pre and post measures and also repeated measures which promoted inquiry into the mechanisms of change. C: The focus of the study was relevant to the current review. D: This study was of relevance to the

						literature review. Included
Stump et al. (1992). Vocabulary intervention for secondary level youth.	Secondary schools, USA.	694 secondary school students and 36 members of staff.	Over 2 years, staff were taught in Precision Teaching methods and then implemented the Precision Teaching techniques to teach vocabulary to students in their schools.	Mixed methods design. ABA Probes were used as a repeated measure.	Evaluations were made on the amount of teacher training was needed to successfully implement the approach. Students with and without specific learning difficulties improved in the accuracy and fluency of their vocabulary knowledge.	A: The study completed qualitative and quantitative measures within a fixed ABA design with a large participant sample. B: This study design reviewed the learning and affective outcomes of PT intervention. C: Although the study has a focus

					Students and teachers provided anecdotal feedback that PT was enjoyable.	on staff views regarding implementation, student views and learning progress are included which is relevant to the current review. D: The study provides relevant data to contribute to the systematic review. Included
Sutton et al. (1984). A case of dyslexia?	Primary school, secondary school and college,	1 male participant.	In the participants' first year of college, Precision Teaching was	This research took an ethnographic case study approach.	Precision Teaching was the intervention which enabled the participant to gain	A: This study was ethnographic but could have been influenced by researcher bias.

	UK		used to systematically teach and monitor progress in handwriting and spelling. The participant received 20 minutes daily with his college tutor on agreed content with an agreed aim rate.		fluency and accuracy in basic literacy skills after his compulsory school career had been dominated by diagnoses of within-child difficulties.	B: Case studies are useful in distinguishing the mechanisms of affective changes within a Precision Teaching intervention. C: This study focussed on intervention at a college level which was not within the inclusion criteria for the literature review. D: This study did

						not meet the original inclusion criteria. Excluded
Sweeney, Ring, Malanga and Lambert (2003). Using Curriculum-Based Assessment and Repeated Practice Instructional Procedures Combined with Daily Goal Setting to Improve Elementary Students Oral Reading Fluency: A Pre-service Teacher Training Approach.	Elementary school, USA.	39 participants in 4th grade of elementary school.	Each session was completed for 45 minutes There were 8 tutors and the groups met 2-3 times each week for five weeks.	Fluency accelerations were analysed to indicate progress.	Fluency in reading significantly improved for most participants.	Unavailable as no access to journal Excluded

Updike and Freeze (2001). Precision reading: improving reading for students with learning disabilities.	Elementary school, Canada.	10 year old male participant.	Precision Teaching and Repeated reading interventions were combined to create Precision Reading.	Case study methodology	After a period of intervention, the participant made progress within his literacy skills.	A: The researcher shows clear understanding of the limits of the study (i.e. to generalisability of the findings). B:The case study design allowed the researcher to develop in depth detail about a single participant. C: The study focussed on how Precision Teaching impacted the literacy

						interventions and affective outcomes for a single participant. D: This study provided relevant outcomes to contribute to the current literature review. Included

8.27 Appendix 27 Literature Review search terms

Database searched	Time period searched	Search terms used to find papers	Number of items identified
PsychINFO (searched in July 2013) Electronic database search	All dates	"School" AND "Precision Teaching" AND "Motivation" AND "Male" AND "Literacy Intervention" "School" AND "Precision Teaching" AND "Motivation" AND "Male"	1 11 Total: 12
Psych INFO (searched in July 2013) Electronic database search	All dates	"Precision Teaching"	Total: 155
ASSIA (searched in July 2013) Electronic database search	All dates	"Precision Teaching" AND "school" "Precision Teaching" AND "motivation" "Precision Teaching" AND "literacy intervention" "Precision Teaching" AND "male"	 Total: 30

		"Precision Teaching" (See Appendix 1 for full list of search terms used)	
Web of Knowledge (WoK) (searched in July 2013) Electronic database search	All dates	"Precision Teaching" "Precision Teaching" AND school "Precision Teaching" AND "motivation" "Precision Teaching" AND "literacy intervention" "Precision Teaching" AND "male" (See Appendix 1 for full list of search terms used)	58 4 2 16 2 Total: 82
Wiley (searched in July 2013) Electronic database search	1980-2013	"Precision Teaching" AND "primary school" "Precision Teaching" AND "motivation" "Precision Teaching" AND "literacy" "Precision Teaching" AND "male" (See Appendix 1 for full list of	44 2 4 1 Total: 51

		search terms used)	
British Journal of Educational Psychology	1980-2013	“Precision Teaching”	Total: 7

The following information details the search method within electronic databases. The key words delineating from each term identified from the research question was searched individually and then combined using the “OR” function in the database search keys. These “OR” combinations were then combined using the “AND” function within the database search keys. The number of results collected from each database search is shown in Table 2.

PsychINFO

Searched 10.7.2013

Key term: School

1. Year* 5
2. Year* 6
3. Grade* 5
4. Grade* 6
5. Primary school
6. Secondary school* OR secondary education OR high school education
7. Infants school*
8. Schools OR middle schools
9. 1 OR 2 OR 3 OR 4 OR 5 OR 6 OR 7 OR 8 OR 9

Key term: Precision Teaching

10. Precision Teaching

Key term: Motivation

11. Motivation OR academic achievement motivation OR achievement motivation OR intrinsic motivation OR extrinsic motivation
12. Cognitive motivation OR self-efficacy OR academic self-concept

13. Social motivation
14. Motivation theory
15. 15 OR 16 OR 17 OR 18

Key term: Male

16. Male
17. Boy OR human male
18. 19 OR 20

Key term: Literacy intervention

19. Literacy intervention OR school based intervention OR literacy OR intervention OR literacy programs
20. Reading
21. Writing
22. Educational program*
23. 22 OR 23 OR 24 OR 25

24. 9 AND 10 AND 15 AND 18 AND 23

25. 9 AND 10 AND 15 AND 18

26. 10

Applied Social Sciences Index and Abstracts (ASSIA)

Searched 3.7.2013

Key terms: Precision Teaching

1. “Precision Teaching”
2. “Precision Teaching” AND “Year 5” or “Year 6”
3. “Precision Teaching” AND “secondary school”
4. “Precision Teaching” AND “high school”
5. “Precision Teaching” AND “primary school” OR “infants school”
6. “Precision Teaching” AND “Grade 5” OR “Grade 6”

7. “Precision Teaching” AND “motivation”
8. “Precision Teaching” AND “cognitive motivation”
9. “Precision Teaching” AND “extrinsic motivation”
10. “Precision Teaching” AND “ intrinsic motivation”
11. “Precision Teaching” AND “motivation theory”
12. “Precision Teaching” AND “social motivation”
13. “Precision Teaching” AND “achievement motivation”
14. “Precision Teaching” AND “literacy intervention”
15. “Precision Teaching” AND “reading”
16. “Precision Teaching” AND “writing”
17. “Precision Teaching” AND “educational program*”
18. “Precision Teaching” AND “literacy program*”
19. “Precision Teaching” AND “male”
20. “Precision Teaching” AND “human male”
21. “Precision Teaching” AND “boys”

Web of Knowledge (WoK)

Searched 3.7.2013

Key terms: Precision Teaching

1. “Precision Teaching”
2. “Precision Teaching” AND “Year 5” or “Year 6”
3. “Precision Teaching” AND “secondary school”
4. “Precision Teaching” AND “high school”
5. “Precision Teaching” AND “primary school” OR “infants school”
6. “Precision Teaching” AND “Grade 5” OR “Grade 6”
7. “Precision Teaching” AND “motivation”
8. “Precision Teaching” AND “cognitive motivation”
9. “Precision Teaching” AND “extrinsic motivation”
10. “Precision Teaching” AND “ intrinsic motivation”
11. “Precision Teaching” AND “motivation theory”
12. “Precision Teaching” AND “social motivation”
13. “Precision Teaching” AND “achievement motivation”
14. “Precision Teaching” AND “literacy intervention”

15. “Precision Teaching” AND “lliteracy”
16. “Precision Teaching” AND “lit*”
17. “Precision Teaching” AND “reading”
18. “Precision Teaching” AND “writing”
19. “Precision Teaching” AND “educational program*”
20. “Precision Teaching” AND “literacy program*”

British Journal of Educational Psychology

Hand searched 13.7.2013

Key terms: Precision Teaching

Dates limited to between 1980 and 2013 and the second search term (additional to Precision Teaching) was refined to be found within the research abstract.

1. “Precision Teaching” AND “primary school”
2. “Precision Teaching” AND “motivation”
3. “Precision Teaching” AND “literacy”
4. “Precision Teaching” AND “male”

Wiley Online

Database search 10.7.2013

Key terms: Precision Teaching

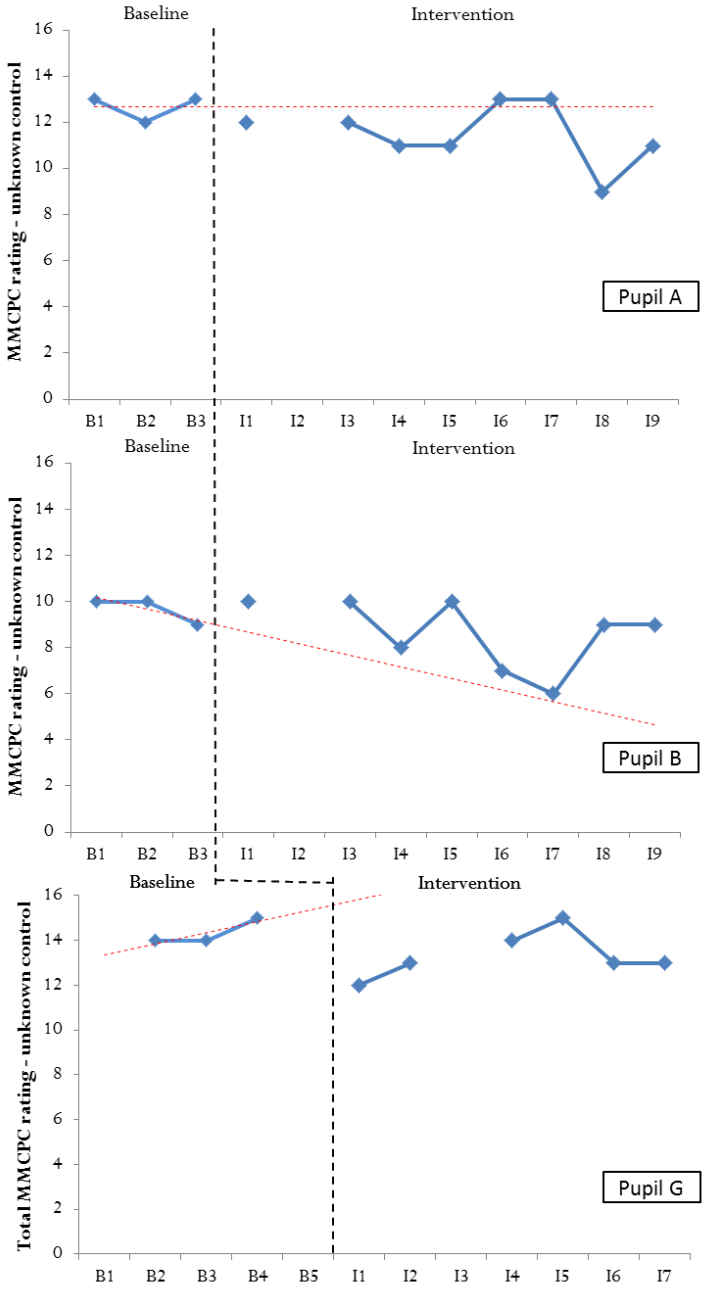
Dates limited to between 1980 and 2013.

1. “Precision Teaching” AND “primary school”
2. “Precision Teaching” AND “motivation”
3. “Precision Teaching” AND “literacy”
4. “Precision Teaching” AND “male”

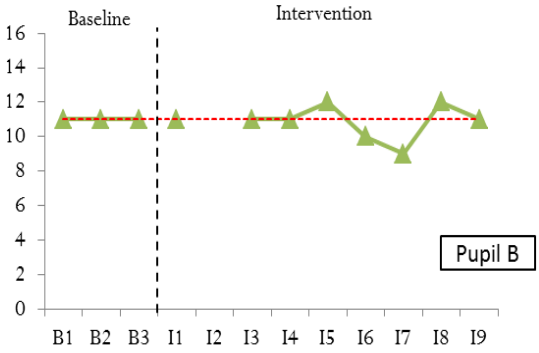
8.28 Appendix 28 Multiple baseline graphs

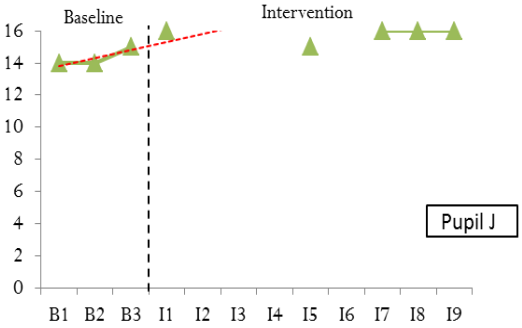
Powerful others control: stable baselines

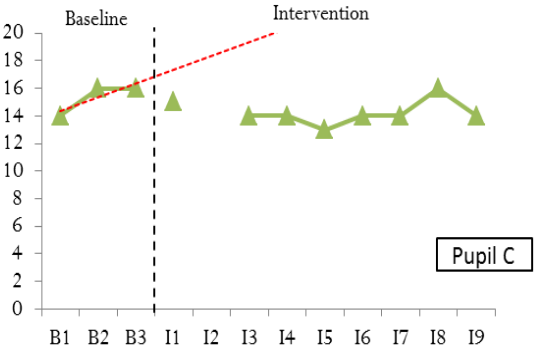
Unknown control: stable baselines

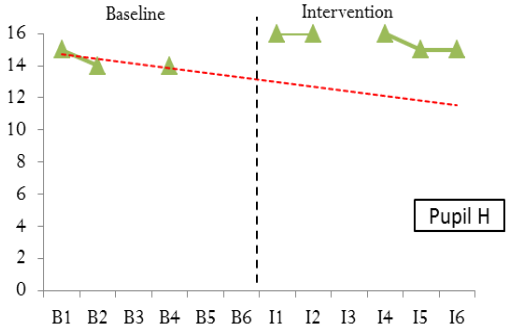


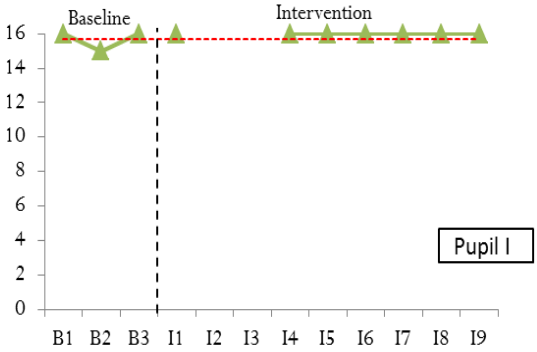
Internal control: stable baselines

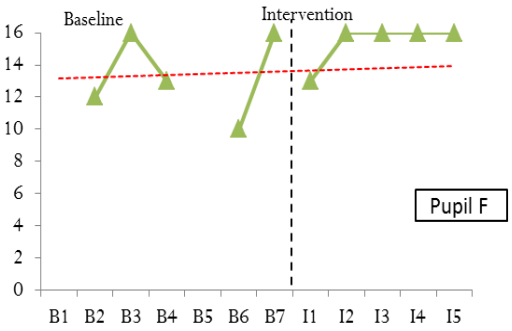




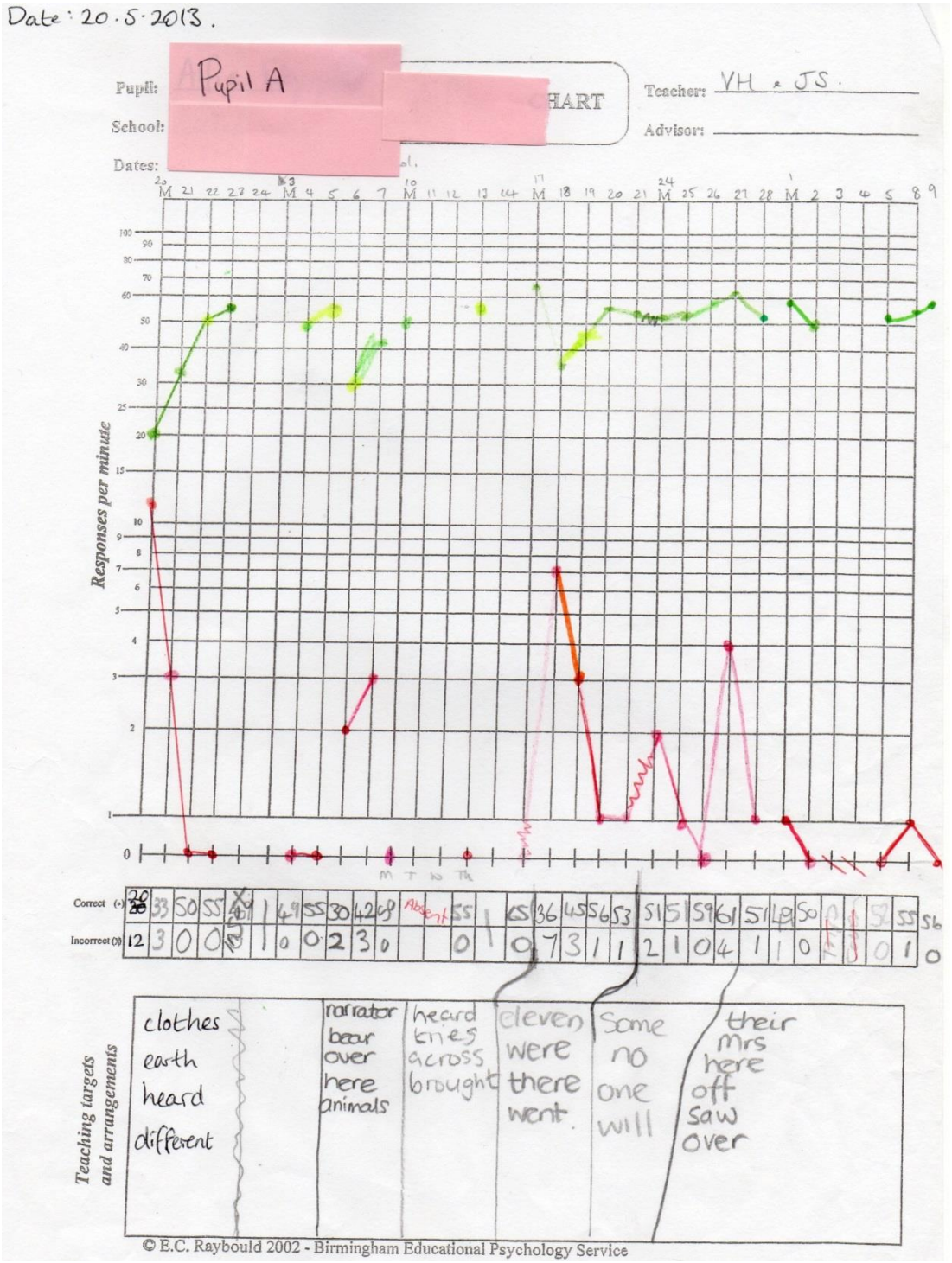


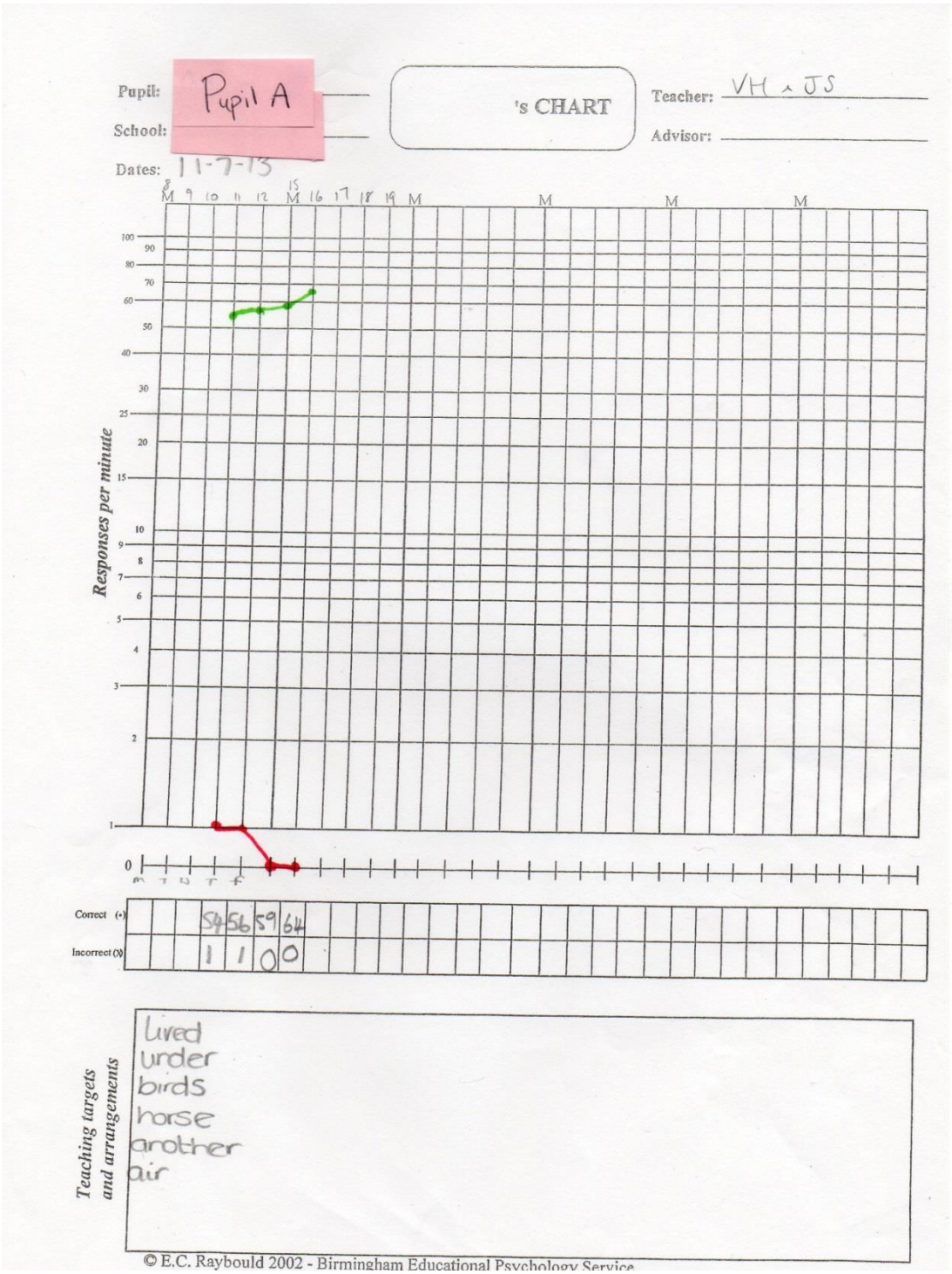




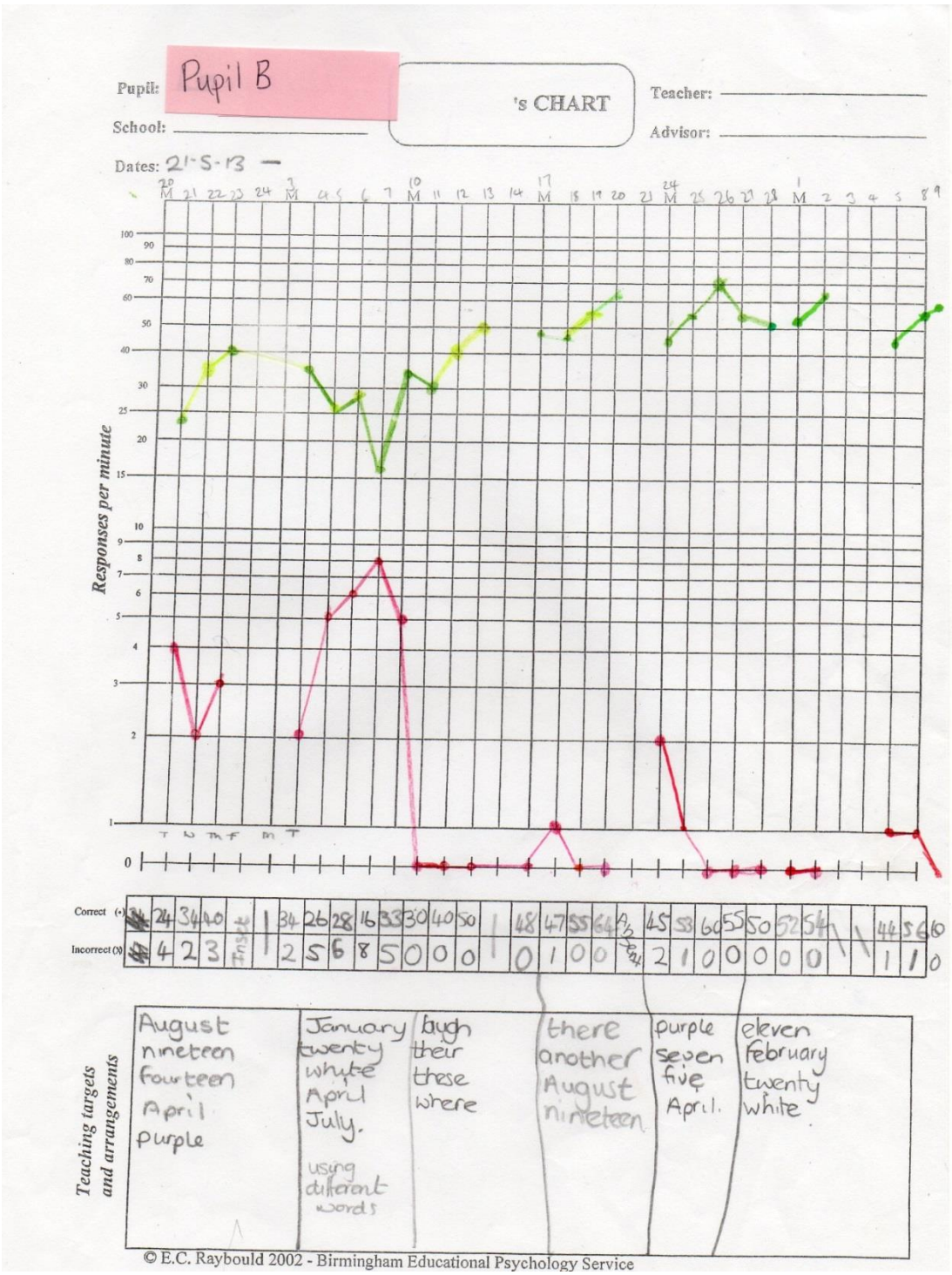


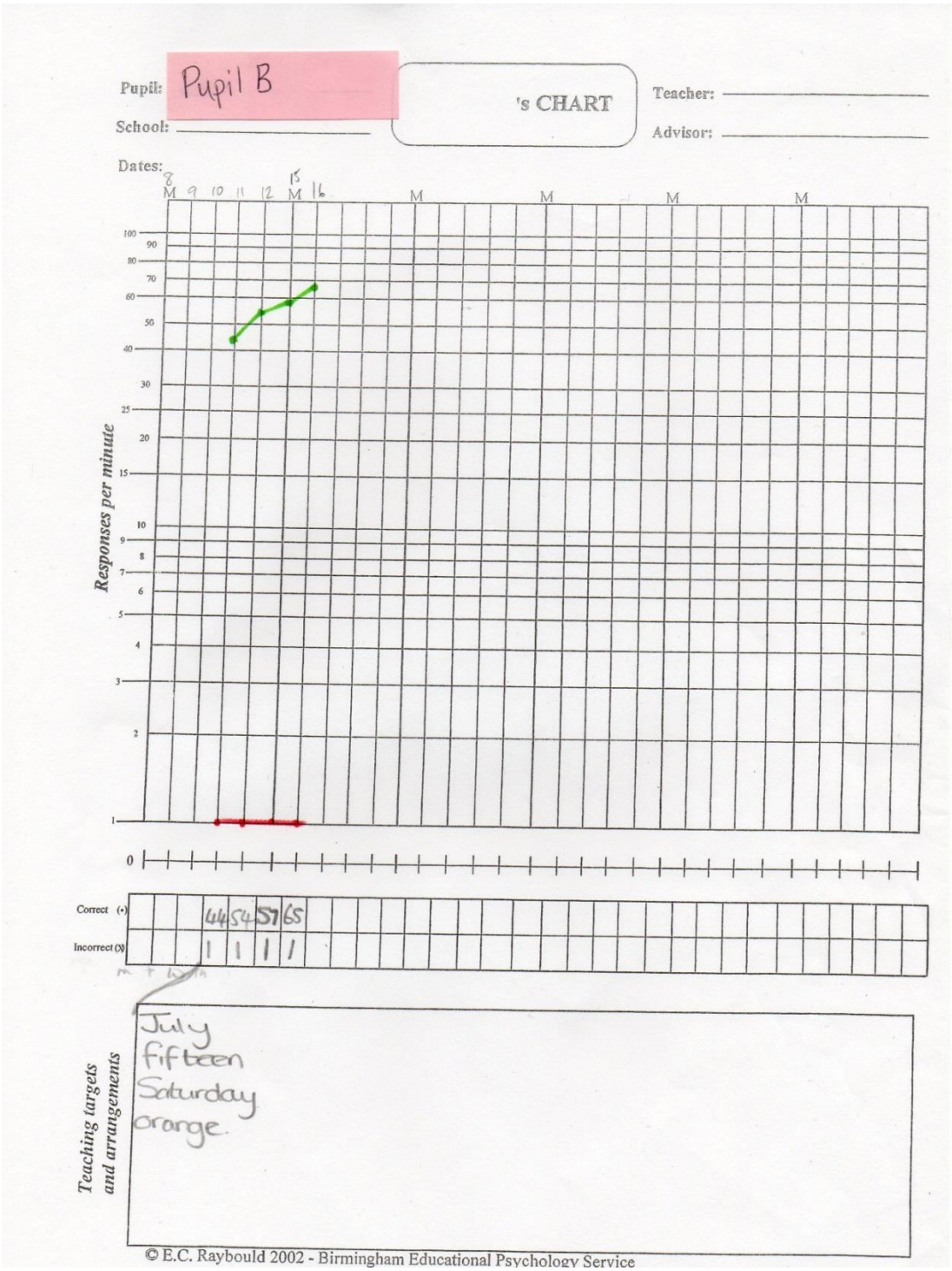
8.29 Appendix 29 Pupil A Precision Teaching chart



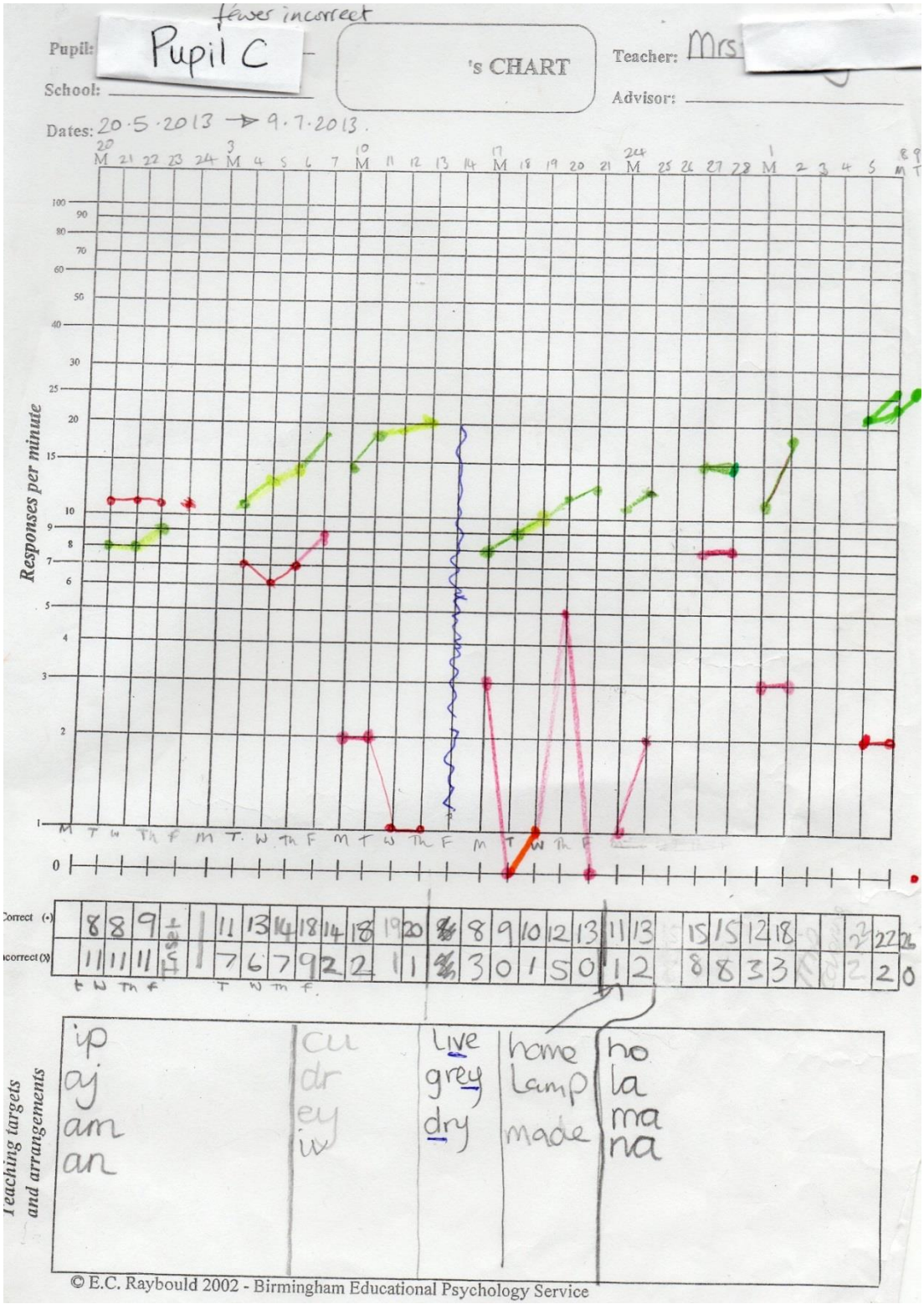

Pupil: Pupil A
School:
Dates: 11-7-13
's CHART
Teacher: VH + JS
Advisor:
Responses per minute
Correct (•)
Incorrect (x)
54 56 59 64
1 1 0 0
Teaching targets and arrangements
lived
under
birds
horse
another
air
© E.C. Raybould 2002 - Birmingham Educational Psychology Service

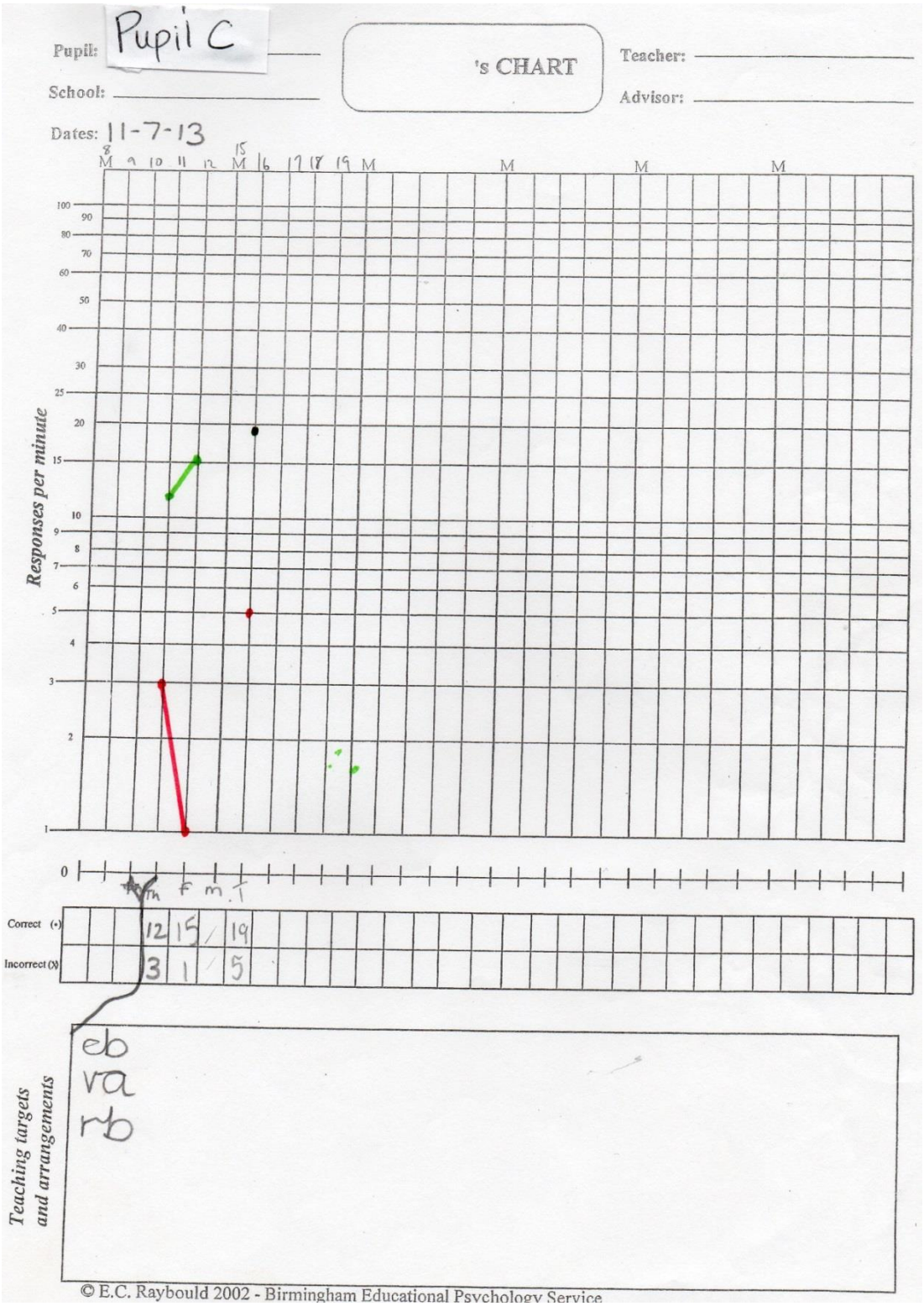
8.30 Appendix 30 Pupil B Precision Teaching chart



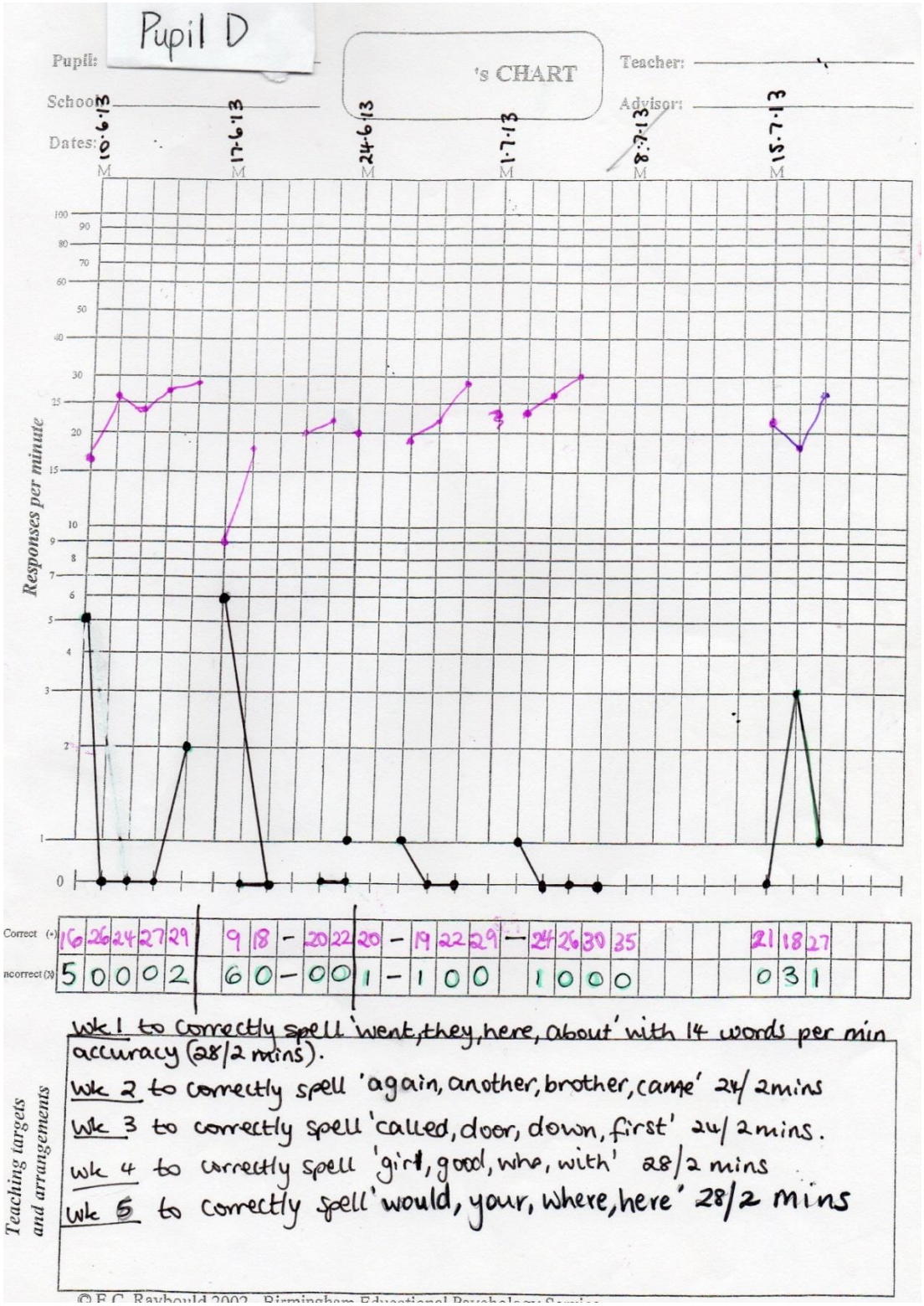

Pupil: Pupil B
's CHART
Teacher:
School:
Advisor:
Dates:
8 M 9 10 11 12 15 M 16
M
M
M
M
Responses per minute
100
90
80
70
60
50
40
30
25
20
15
10
9
8
7
6
5
4
3
2
1
0
Correct (•)
Incorrect (x)
44 54 57 65
1 1 1 1
Teaching targets and arrangements
July
fifteen
Saturday
orange.
© E.C. Raybould 2002 - Birmingham Educational Psychology Service

8.31 Appendix 31 Pupil C Precision Teaching chart




Pupil: Pupil C
's CHART
Teacher:
School:
Advisor:
Dates: 11-7-13
Responses per minute
Correct (•)
Incorrect (x)
12 15 / 19
3 1 / 5
Teaching targets and arrangements
eb
va
rb
© E.C. Raybould 2002 - Birmingham Educational Psychology Service

8.32 Appendix 32 Pupil D Precision Teaching chart



8.33 Appendix 33 Inter-rater script for multiple baseline visual analysis

Inter-rater agreement script created with reference to information from Barlow et al. 2009; Kazdin, 1984; Harbst et al. 1991, Syme, 2011 and Kratochwill et al. 2010.

Inter-rater agreement of single case experimental design graphs.

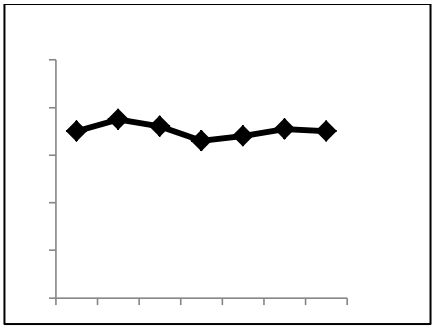
The aim of this task is to gain agreement from a number of different people about the baseline stability of data points shown in each graph.

This research project has been designed to review the impact of an intervention on the motivation of pupils towards literacy. This project was completed as a single-case experimental design (SCED). In this design, repeated measures are taken to review the effects of an intervention over time. Each pupil was asked to give a rating of their feelings of control over their literacy success and learning. These ratings were given by each pupil every week. The scores have been plotted on a graph.

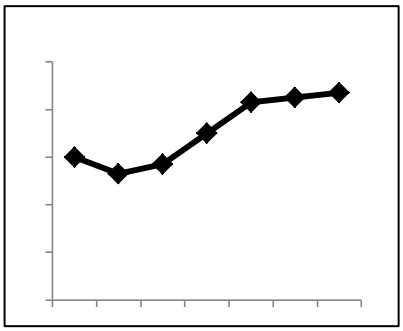
There are two parts to each graph, the baseline (A) and the intervention phase (B). The baseline is when the pupil was not receiving the intervention, and the intervention phase is the period of time that the intervention was in place.

This task aims to establish whether the data points in the baseline phase are at a stable level. Within single case experimental designs (SCEDs), it is important that the data given in the baseline phase is at an even level before the intervention phase is introduced. This is to see whether there has been a change between the baseline and intervention performance. If the baseline is stable and the intervention phase has a large increase or decrease in comparison to the baseline, researchers are more able to conclude that the intervention might have made a difference.

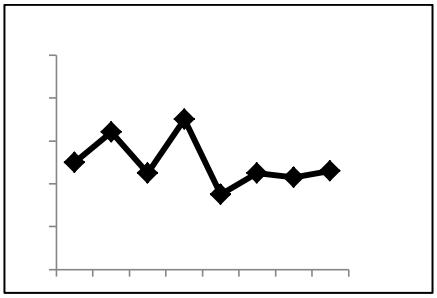
After review of the single case design literature (Barlow et al. 2009; Kazdin, 1984; Harbst et al. 1991), the graphs below give examples of the types of baseline which can occur in SCEDs.



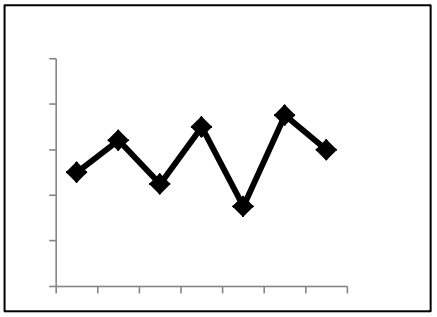
Stable



Increasing



Variable-stable



Variable

You will be shown a number of graphs. Please look at the baseline phases and compare them to the examples above. Then give your agreement rating for each graph in answer to the following statement.

“After reviewing the baseline phase, I am confident that the baseline data is stable.”

Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree

Thank you!

8.34 Single case MMCPC graph inter-rater script

Inter-rater agreement script created with reference to information from Barlow et al. 2009; Kazdin, 1984; Harbst et al. 1991, Syme, 2011, Slack, 2013 and Kratochwill et al. 2010.

Inter-rater agreement of single case experimental design graphs.

The aim of this task is to gain inter-rater agreement about the level of effect shown on each graph.

Project information

This research project has been designed to review the impact of an intervention on the motivation of pupils towards literacy. To measure this, pupils rated their feelings of control over their learning.

This project was completed as a single-case experimental design (SCED). In this design, repeated measures are taken to review the effects of an intervention over time. Each pupil was asked to give a rating of their feelings of control over their literacy success and learning. These ratings were given by each pupil every week. The scores have been plotted on a graph.

There are two parts to each graph, the baseline (A) and the intervention phase (B). The baseline is when the pupil was not receiving the intervention, and the intervention phase is the period of time that the intervention was in place.

This task aims to establish whether there has been a significant change between the baseline and intervention phases in each graph.

Within single case experimental designs (SCEDs), it is important that the data given in the baseline phase is at an even level before the intervention phase is introduced.

After review of the single case design literature (Barlow et al. 2009; Kazdin, 1984; Harbst et al. 1991), the graphs below give examples of the types of changes which can occur in AB single case experimental design research:

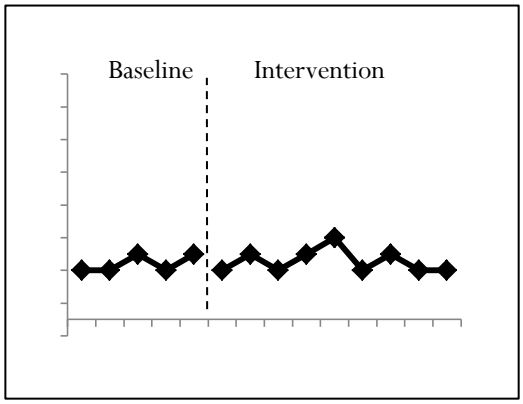


Figure.1 No change between baseline and intervention phases

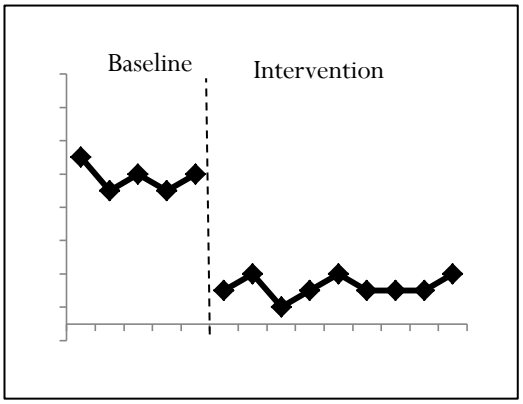


Figure 2. Decrease between baseline and intervention phase

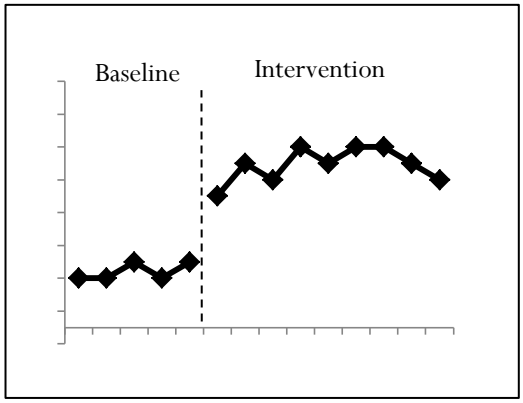


Figure 3. Increase between baseline and intervention phases

Task guide

Pupils were asked to rate their feelings of unknown, powerful others and internal control over their literacy learning. For each participant you will be shown five graphs for one of the above elements of control. Each graph contains exactly the same data but has different additional information to support your analysis. This information is explained below:

Variable	Description	Outcomes
Level	Separate mean scores of the data points in the baseline and intervention phase.	Where the mean score is higher or lower between the baseline and intervention phases, this may indicate a change as a result of the intervention.
Trend	The line of best fit of the data in the baseline and in the intervention phase. These lines also indicate where the data would be projected to be.	The line of best fit should be level in the baseline phase to indicate stability of the data (Barlow et al. 2009). The line of best fit within the intervention phase indicates an increasing, stable, or decreasing trend.
Variability	The range of scores present in the baseline and intervention phase.	Where the data points are less spread out, this indicates that the data set is stable. This may indicate a more reliable set of data, and a more reliable change if observed in other graphs.
Immediacy of effect	Highlights the change in the last three data points in the previous phase in comparison with the first three data points in the next phase.	If the data points at the start of the intervention phase are different to those in the baseline phase, this indicates an immediate effect of the intervention.
Overlap	Indicates the amount of overlap between the data points in the baseline and the intervention phases.	The less overlap between data points in the baseline and intervention phases, the greater the indication of an effect.

Pupil C: powerful others control

After looking at the 5 graphs, please give your agreement rating to the following statements:

1. “After reviewing the baseline phase, I am confident that the baseline data is stable.”

Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree

2. “There is a change between the baseline phase and intervention phase data.”

Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree

If you observe a change in the data between the baseline and intervention phases, please rate your level of agreement to the following statement:

3. “There is a significant increase or decrease change between the baseline and intervention data.”

Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree

Please also indicate whether there is an increase or decrease change:

	Agree/Disagree
Significant increase change between phases	
Significant decrease change between phases	

8.35 Appendix 35 Email from Ted Raybould

Sent: 18/11/2013, 13:56
To Anna Critchley [lpxac4@nottingham.ac.uk]

Hello Anna

Thanks for your enquiry and sorry to be a bit slow in getting back. I'm very happy to provide some thoughts. My own view, as you probably suspected, is that for a p.t. programme to be most effective - daily is optimal, though 4 days p.w. would be acceptable. The rationale for this is clear - it's based on a principle derived from research (i.e. the effectiveness of 'distributed' as opposed to 'massed' practice). That's why I've tended to stick with the original term 'precision teaching' (rather than precision 'recording' or whatever) because this emphasises the fundamental importance of teaching, on a frequent basis, in a precise way. The daily probing and charting are simply tools to keep the teaching precise, to establish 'what works best' and thereby to be as effective as possible. Given the economy of p.t. in the use of teaching time, most schools, once committed, find a way to do this. However, I do appreciate that circumstances are not always ideal.

I've attached an extract (p.8) from Haring NG et al. (1978) 'The fourth R - Research in the classroom', Chas. E . Merrill. This gives a classic view on daily measurement, though the whole chapter by Haring himself (Chapter 1: Research in the classroom: problems and procedures') is well worth reading.

If some of your school(s) have provided only 3 brief sessions per week but have done it consistently, you can still, of course, try to evaluate what were the learning outcomes and the effects on pupils' motivation, provided you qualified the nature of the p.t. programme accordingly. It's methodologically too complex to compare the two 'conditions' (those employing 5 days p.w. vs. 3 days p.w.) as I imagine that overall numbers are relatively small. Though, I would be curious to know if there were any observed differences which might be (very tentatively) commented upon.

I think it's important to remember that a p.t. programme has several different, potentially 'motivational' components, all wrapped up in a single

(e.g. ten-minute) session: the task is set with care at the optimum level, the session is brief, it is (or should be) fun, a motivational challenge is presented (i.e. to beat the last rate), it has immediate feedback of success. And the fundamental component, of course - the teaching. How often has the pupil been receiving this in relation to the specific target set? (i.e. regardless of whether he is given a probe and his results charted). If not at all, or perhaps only some 'incidental' learning may have occurred, again, you would need to qualify your findings accordingly.

I would be interested to know how you had ascertained the pupils' levels of motivation (as distinct from actual task performance). I'm wondering if you, for example, interviewed the pupils or used a simple rating scale or somesuch? Don't worry if you haven't, however, because you can always bring in afterthoughts and ideas for future research in this area into your write-up.

I think real-world, classroom research such as you have embarked on is always very difficult but very worthwhile provided we can tease out the variables at work. Whether or not these are 'controlled for' in the design (and I know of no design that's watertight) the important thing is to explore and acknowledge possible alternative explanations. And to suggest the next line of research! You may know of a text which I've always found useful in this area: Campbell DT & Stanley JC (1966): 'Experimental and quasi-experimental designs for research', Chicago; Rand McNally.

I hope this has been of some help. There's rarely a short answer to a short question, is there?

All the best with your write-up. If I can be of further help, let me know.

Ted

8.36 Appendix 36 Computation of Fleiss Kappa for multiple baseline inter-rater agreement

Unknown control

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Pupil A					3
Pupil B				2	1
Pupil C			1	2	
Pupil E			2	1	
Pupil F		1	2		
Pupil G				3	
Pupil H			1	2	
Pupil I			1	2	
Pupil J	1	2			
q	0.037037	0.111111	0.259259	0.444444	0.148148

m	3
n	9
pa	0.481481
pe	0.300412
k	0.258824

Powerful others

	Strongly disagree	Disagree	Neither agree nor	Agree	Strongly agree

			disagree		
Pupil A				2	1
Pupil B					3
Pupil C			1	2	
Pupil E	1	1	1		
Pupil F		2	1		
Pupil G				3	
Pupil H				1	2
Pupil I		2	1		
Pupil J				2	1
q	0.037037	0.185185	0.148148	0.37037	0.259259

m	3
n	9
pa	0.444444
pe	0.262003
k	0.247212

Internal control

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Pupil A			1	2	
Pupil B					3
Pupil C				3	
Pupil E		3			
Pupil F				3	
Pupil G	2	1			
Pupil H				3	

Pupil I					3
Pupil J				2	1
q	0.074074	0.148148	0.037037	0.481481	0.259259
m	3				
n	9				
pa	0.777778				
pe	0.327846				
k	0.669388				

8.37 Appendix 37 SCED timelines

The following timeline provides an overview of baseline (B), and intervention (I) phases for all pupils within the study. Shaded blocks correspond to school holiday periods.

	w/b 29.4.2013	w/b 7.5.2013	w/b 13.5.2013	w/b 20.5.2013	W/b 27.5.2013	w/b 3.6.2013	w/b 10.6.2013	w/b 17.6.2013	w/b 24.6.2013	w/b 1.7.2013	w/b 8.7.2013	w/b 15.7.2013
Pupil A	B	B	B	I		I	I	I	I	I	I	I
Pupil B	B	B	B	I		I	I	I	I	I	I	I
Pupil C	B	B	B	I		I	I	I	I	I	I	I
Pupil I	B	B	B	I			I	I	I	I	I	I
Pupil J	B	B	B	I			I	I	I	I	I	I
Pupil G	B	B	B	B		I	I	I	I	I	I	I
Pupil E	B	B	B	B		I	I	I	I	I	I	I

Pupil H	B	B	B	B			I	I	I	I	I	I
Pupil D	B	B	B	B			I	I	I	I	I	I
Pupil F	B	B	B	B		B	B	I	I	I	I	I

8.38 Appendix 38 RCI calculation for MALS (Burden, 1999) measure

Christenson and Mendoza (1986) made some alterations to the original RC index, and proposed that it could be completed using the following formula:

$$\mathrm{RC} = \frac{\mathrm{x2} - \mathrm{x1}}{Sdiff}$$

Within this formula

- x2 represents the participants' post-test score and x1 the participants' pre-test score.
- Sdiff represents the calculation of the standard error of the difference between the pre-test and post-test scores.

Sdiff is therefore a calculation of the range of scores which could be expected if no reliable change occurred in the data set and incorporates measurement error or limitations of the measure itself.

Sdiff can be calculated using the following formula, where SE represents the standard error of the measurement using to gather the data.

$$\text{Sdiff} = \sqrt{2\ (SE)}^2$$

For the Myself as a Learner Scale (MALS) (Burden, 1999) the standard error (SE) is reported as 0.534.This was incorporated into the formula to find the Sdiff score for the MALS measure and was calculated as:

$$\text{Sdiff} = \sqrt{2\ (0.534)}^2$$

The above formula is calculated as follows:

0.534×0.534 = 0.2851

2×0.2851 = 0.5702

√0.5702 = 0.755115

Therefore the Sdiff calculation for the MALS measure is:

$$\text{Sdiff} = \sqrt{2\,(0.534)^2} = 0.76$$

This results in the following RCI formula for the MALS measure:

$$\text{RC} = \frac{\text{x2} - \text{x1}}{0.76}$$

8.39 Appendix 38 Ethics approval letter

AS/hcf

Ref. 298

Thursday 4 April 2013

Dear Anna Critchley,

Ethics Committee Review

Thank you for submitting an account of your proposed research '[Investigating the effect of Precision Teaching on the self-efficacy and motivation towards learning of male pupils in Years 5 and 6'.

That research has now been reviewed, to the extent that it is described in your submission, we are pleased to tell you it has met with the Committee's approval.

However:

Please note the following comments from our reviewers;

1. Debrief Information sheets: "...your son's name will be anonymised…" is a bit strange. maybe better to write "…your son's data will be will anonymised". Same for the letter to members of staff. Rather than that names will be anonymised it is the data that anonymised or names are removed from the data.

Final responsibility for ethical conduct of your research rests with you or your supervisor. The Codes of Practice setting out these responsibilities have been published by the British Psychological Society and the University Research Ethics Committee. If you have any concerns whatever during the conduct of your research then you should consult those Codes of Practice.

Independently of the Ethics Committee procedures, supervisors also have responsibilities for the risk assessment of projects as detailed in the safety pages of the University web site. Ethics Committee approval does not alter, replace, or remove those responsibilities, nor does it certify that they have been met.

Yours sincerely

Dr Alan Sunderland

Chair, Ethics Committee