An evaluation of the effectiveness of the SHAPE CODING™ System in improving the writing skills of children who are Deaf.

A study submitted in partial fulfilment of the requirements for the degree of Master of Arts of the University of Hertfordshire

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May 2022

Ethics Protocol Number: EDU/PGT/CP/05296

Word Count: 11,319

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Abbreviations

ALD	Assistive Listening Device
ASL	American Sign Language
BAHA	Bone Anchored Hearing Aid
BSL	British Sign Language
CI	Cochlear Implant
CWAD	Children Who Are Deaf
DLD	Developmental Language Disorder
EAL	English as an Additional Language
EAS	Electric Acoustic Stimulation
HA	Hearing Aid
SEN	Special Educational Needs
SIWI	Strategic and Interactive Writing Intervention
SSE	Sign Supported English
STA	Specialist Teaching Assistant
TC	Total Communication
QToD	Qualified Teacher of the Deaf

Acknowledgements

I would like to sincerely thank my supervisors for this study. To Lorna Gravenstede, not only for her patience and expertise but also for her passion and belief in this project. My thanks also to Joy Rosenberg who offered invaluable feedback on Ethics and Methodology.

Thank you to Susan Ebbels, who created the SHAPE CODING™ System and very kindly gave her permission for this study.

My thanks also to my colleagues, Beth Welstead and Ruth Everingham for their wise words and continual encouragement. Without them, this research would not have been possible.

Thank you to my wonderful husband, Andrew Bailey, for his unending love and support.

Finally, I would like to express my immense gratitude to the incredible staff and pupils who participated in this project. You continue to challenge me, amaze me and inspire me. Thank you.

Abstract

This research examines the efficacy of the SHAPE CODING™ System on the writing abilities and writing confidence of eight primary school aged children, all with severe to profound hearing loss and delayed or disordered language.

The SHAPE CODING™ System (Ebbels, 2007) is a visual coding system that teaches spoken and written grammar rules through the use of colours, shapes and lines. It was first developed for children with Developmental Language Disorder (DLD) and much research has been done on its use with that demographic. There has as yet, however, been no published research on the use of the SHAPE CODING™ System with children who are deaf (CWAD). This study aims to rectify that, through an exploration of the hypotheses that use of the system has a positive effect on CWAD writing and a positive effect on CWAD confidence to write.

These hypotheses were tested through an action research project involving multiple case studies of children between 6 years and 11 years old, all attending a primary school with a resource base for deaf students. Pre- and post-intervention assessments, using the Oxford Analytic Assessment of Deaf Writing (Burman et al., 2008), examined the extent to which use of the SHAPE CODING™ System impacts on CWAD ability to form and use correct grammatical structures, as well as to develop narrative skills. Pre- and post-intervention pupil and staff voice surveys were also analysed to identify changes in CWAD confidence when writing, perceptions of CWAD as writers and CWAD enjoyment of writing.

The findings of this study were that all participant CWAD made statistically significant progress in writing, with post-intervention writing samples showing that they were able to write at greater length, using a wider range of correct grammatical structures, and with improvement in narrative skills. The results of staff and pupil voice surveys also indicated that CWAD had greater confidence and enjoyment of writing post-intervention, with both staff and CWAD identifying that the system was helpful. It can therefore be concluded that The SHAPE CODING™ System is a useful tool for professionals to use with primary school-aged CWAD when teaching writing.

1. Introduction

It is well established that across all phases of education, as a group, children who are deaf (CWAD) do not reach the same levels of attainment in writing when compared to their peers (NDCS, 2020; Williams & Mayer, 2015). It is therefore important to find successful ways to support pupils in closing the gap but unfortunately there is a dearth of research relating to writing instruction (Strassman & Schirmer, 2013; Williams & Mayer, 2015).

The researcher was first introduced to the SHAPE CODING™ System (Ebbels, 2007) as a tool that could potentially help to improve the grammar of CWAD by the local speech and language therapy service. At that time, the researcher was teaching a primary school aged child with profound deafness, whose first language was British Sign Language (BSL). This child was cognitively and academically very able but had poor written English grammar as they wrote in BSL structures. When the SHAPE CODING™ System was introduced, the child enjoyed using it, and found it a helpful way to understand English grammar. There were clear rules that could be followed and the visual coding made it memorable. The researcher therefore became interested in whether it would have the same effect on other Deaf students, and whether writing attainment could be improved through the use of this system.

While there is currently no published research on the use of the SHAPE CODING™ System with CWAD, there is research to suggest that it can be used with pupils with language impairments in order to improve their expressive grammar. This includes aspects such as past tense production (Ebbels, 2007; Kulkarni et al.; 2013; Calder et al., 2020) and verb argument structures (Ebbels et al., 2007). These are also errors common to CWAD (Wolff, 2011) and it can therefore be expected that the use of the SHAPE CODING™ System would support the development of CWAD expressive grammar in the same way as it does children with language impairment.

This study is timely, not only because research on writing interventions for CWAD is sorely needed, but also because an increasing number of schools for the deaf, resource provisions and speech and language services are using visual coding strategies with their pupils (McAleer, 2011). It is important that interventions carried

out are grounded in evidence and therefore a study into the SHAPE CODING™ System's efficacy is of vital importance.

This study will explore and review the current body of academic research around CWAD writing, visual tools and the SHAPE CODING™ System. The methodology section will explain the design of the study and the rationale behind it and the data from the study will be presented in the results section. The discussion will link the results of the study to the current published research and the researcher will then present their conclusions and recommendations for future practice.

2. Literature Review

2.1 Search Strategy

In order to complete a thorough literature review, an initial search using SCOPUS was completed for available research papers (see Table 1). A range of terminology was used to ensure that all possible article titles were covered. The results were then narrowed down to abstracts that met either the broad criteria of Deaf writing or the SHAPE CODING™ System, and from there papers with a strong relevance to this study were identified to include in the review.

Table 1: Literature search results

Search terms	Database	Titles	Abstracts	Papers
Deaf + writing	Scopus	658	68	18
Deaf + writing + intervention	Scopus	45	15	8
"Hard of hearing" + writing	Scopus	133	14	2
"Hard of hearing" + writing + intervention	Scopus	17	6	2
Deaf + Shape Coding	Scopus	7	0	0
"Hard of hearing" + Shape Coding	Scopus	1	0	0
"The Shape Coding System"	Scopus	3	3	3

Further literature was found through searches within the electronic library of the University of Hertfordshire and Google Scholar, using the same search terms and evaluation process as above. Some papers were also found through citations in other works.

2.2 Why is the ability to write important?

The ability to write coherently and at a good standard is essential if children who are deaf (CWAD) are to participate fully in education, attain qualifications and have good employment prospects in adult life (Lederberg et al., 2013; Mayer et al., 2016). All aspects of modern societal living require a high level of literacy (Albertini & Schley, 2011) and individuals without those skills risk becoming 'effectively disenfranchised' (DfE, 2014: 3). If CWAD are to have the future they deserve, and are capable of achieving, then it is vital that effective support exists to enable them to flourish.

2.3 Why is it necessary to develop writing interventions for Deaf children?

2.3.1   Attainment data

When the attainment data of primary school aged CWAD is analysed, it becomes clear as to why support and interventions are deemed necessary. As can be seen in Table 2 and Table 3, only 44% of Key Stage 1 CWAD in the UK met the expected standard for writing in 2019, and only 58% of Key Stage 2 CWAD (NDCS, 2020). This is approximately 30% lower than their peers with no identified special educational needs (SEN), a disparity which has not changed since 2016. Earlier data has been excluded from the analysis due to the introduction of the new National Curriculum, rendering statistics prior to 2016 incomparable with more recent figures. The average rate of progress for CWAD is -0.5. A negative score shows that a pupil, or pupil group, has made less progress than their peers who achieved the same results in the Key Stage 1 assessments. A score of 0 would show that the same progress has been made compared to peers with the same previous results. The progress rate of -0.5 therefore shows that CWAD fall behind as they progress through primary school and it is vital that strategies are put in place in order to close the attainment gap.

This lack of progress is not limited to UK CWAD. A study by Williams & Mayer (2015) in the United States found that by the time that CWAD leave education at 18yrs, their writing is on average at the level of an 8-10yr old hearing child.

Table 2: Proportion of children achieving expected standard at Key Stage 1 for writing

Year	Deaf Children	Children with no identified SEN	All Children
2019	44%	78%	69%
2018	48%	79%	70%
2017	42%	77%	68%
2016	41%	74%	66%

Table 3: Proportion of children achieving expected standard at Key Stage 2 for writing

Year	Deaf Children	Children with no identified SEN	All Children
2019	58%	88%	78%
2018	59%	88%	78%
2017	55%	86%	76%
2016	54%	84%	74%

2.3.2 Causes of low attainment

The causes of low writing attainment remain unclear (Harris & Marschark, 2011; Mayer, 2010). Knoors and Herman suggested in 2010 that CWAD should be able to achieve at the same level as their hearing peers, although the researchers quantify that statement to 'under specific conditions' and 'in postsecondary education' (Knoors & Herman, 2010: 68).

There are several factors, however, that researchers feel affect the writing attainment of CWAD. Marshark and Knoors (2012) found that cognitive function differs between CWAD and hearing children, particularly in areas such as working memory and executive functioning. Hall et al. (2017) identified that part of executive functioning includes the ability to 'retain and manipulate information in memory, think ahead to solve problems, and maintain focus' (2017:9), all skills which are necessary for producing coherent writing. Difficulties in these areas would have a significant impact on writing ability.

There is also a link between language levels and writing ability. The majority of CWAD do not develop language at the same rate as their hearing peers and therefore find it difficult to develop written literacy (Kilpatrick & Wolbers, 2019). Mayer (2010) found that CWAD writing samples were very similar to writing samples from learners with language-learning disorders, and that both groups produced short texts that demonstrated difficulties with grammar, text organisation and spelling. Conversely, in a study of cochlear implant users, it was observed that the access, and subsequent development, of spoken language by CWAD led to better literacy outcomes (Mayer et al., 2016).

2.3.3 Typical writing features of Deaf children

Writing encompasses a range of skills but this study takes as its focus the development of written grammar. CWAD often form non-standard grammatical structures which are not seen amongst their hearing peers (Kim, 2012; Wolbers et al., 2012; Singleton et al., 2004). Writing is an expression of language and while hearing children, unless they have additional needs, will be able to rely on a developed first language to help them to construct written sentences, many CWAD will still be developing their first language, whether spoken or signed, while being taught text-based literacy (Swanwick & Watson, 2005). They will therefore make errors consistent with their incomplete knowledge of language. Missing or incorrect determiners such as 'boy is sick' or 'the some apple' are commonplace (van Beijsterveldt & van Hell, 2010), along with subject verb agreement errors such as 'the girl were fishing' (Wolff, 2011), and verb errors such as 'the boy is sad because it is rain' or 'where the girl?' (Wolff, 2011).

2.4 Current writing interventions and their efficacy.

There is very little research around writing interventions for CWAD. One review of the existing literature (Strassman & Shirmer, 2013) found just 16 studies over 25 years. Another review (Williams & Mayer, 2015) found only three studies, although the focus of their paper was on research surrounding a specific age group. Both papers concluded that there is a need for further research as the current body of literature is severely limited. The interventions discussed below are those that

specifically looked to improve CWAD's written grammar and syntax, which this paper also takes as its focus, as opposed to spelling, content or vocabulary.

2.4.1 Community of Practice

Community of Practice (Kluwin & Kelly, 1991) paired primary and secondary aged CWAD (9yrs-18yrs old) with similarly aged hearing peers. Students corresponded through dialogue journals, sharing interests, feelings, ideas and experiences. 153 journals were analysed. The improvement in the quality of pupils' writing was found to be related to the relationship between the writing pairs, as well as the initial skill level of the CWAD. While there was a definite correlation between the number of journal entries that were written and the improvement in the CWAD's syntax, it was also noted that the pupils who made the most progress were those who had started the intervention with the ability to construct more complex sentences. This intervention, while successful for some CWAD, requires a certain existing level of literacy in order for it to realise its full potential in developing written language.

2.4.2 Morning Message and Strategic and Interactive Writing Intervention (SIWI)

Morning Message (Mariage, 2001) and SIWI (Wolbers, 2008a) also take a collaborative approach to writing, with teachers and CWAD discussing together how to construct a text. Behind both interventions is the belief that children need to take ownership of their writing through developing purposeful texts (Wolbers, 2008b). Morning Message was designed to be a 15-30 minute daily writing activity where a text was constructed through discussion, with the teacher writing the children's sentences verbatim on the board. The group would then read through the text to identify and edit grammatical errors, with the help of metacognitive questioning from the teacher, e.g. 'Why should we change that?' or 'When do we need to use that?' (Wolbers, 2008b). After the intervention period, Wolbers saw gains in correct use of verb tenses, prepositions and subject-verb agreement but no gain, or even negative progress in prepositional phrases, complex and compound sentences and negation. It should be noted however, that the intervention period was only 21 days and does not therefore show whether the strategy had a long term effect on the children's ability to write.

SIWI was a development of the Morning Message intervention which built on the supported writing sessions using the acronym POSTER (plan, organize, scribe, translate, edit, revise) to take CWAD through the stages of producing a text. Notice, Instruct and Practise (NIP-it) sessions were also used to provide more explicit teaching of areas missing from children's writing (Strassman & Schirmer, 2015). Wolbers et al. (2014) found that children who engaged with SIWI showed fewer American Sign Language (ASL) features in their writing after one year of intervention, although the sample size of the study was small with only 29 students, all of a similar age (American school grades 6-8) and with no control group. It is also difficult to ascertain whether progress was made solely from the intervention, or from progress made naturally as the children matured.

2.4.3 Visual Input Enhancement

The use of Visual Input Enhancement, as devised by Berent et al. (2009), was shown to be a useful approach to developing written grammar, not only immediately following teaching input but also long term. The research was a small scale study of 34 college students (average age of 20 years and 3 months) who were deaf, with an intervention group of 18 and a control group of 16. Those in the intervention group were given feedback on an essay using 'visual enhancements' - symbols to indicate incorrect grammatical constructions - and then time to edit and revise their work. Over the 10 week intervention, students made significant improvement in the use of the targeted grammatical constructions. When they were asked to complete an essay 5 months after the intervention had ended, those who had received Visual Input Enhancement showed retention of the syntactic structures learnt, with only a slight reduction in knowledge. The control group received no feedback on their work and subsequently made no progress, with very similar group scores for the first, last and delayed essays (Berent et al., 2009).

The research indicates that use of targeted, visual interventions is important in developing the writing skills of college students. Research with other age groups would therefore be useful in confirming and extending these findings.

2.5 Using the SHAPE CODING™ System to teach writing.

2.5.1 Dual encoding and Metacognition

The SHAPE CODING™ System (Ebbels, 2007) uses visual cues to support the development of grammatical structures. This builds on the theory of Dual Coding which was first proposed by the psychologist Alan Paivio in 1969. The theory states that the mind processes information in two ways – visually and verbally (Paivio, 1969). It is therefore important to supplement the difficulties that CWAD have in processing verbal information with visual cues. Marschark and Knoors (2012) also found that CWAD have poor metacognition – the ability to think about their thinking – and are often unaware of where they are successful or unsuccessful in their learning. Visual cues and strategies are therefore helpful in supporting students to identify and improve errors and misconceptions. While Marschark and Knoor's research was around the development of reading, it seems reasonable to suggest that these conclusions would also extend to writing, and that the use of Dual Encoding to improve metacognition can only be a positive step in developing the writing skills of CWAD.

2.5.2 Colours and shapes to support the development of syntax

The use of shapes and colours to teach grammar and syntax is not new. In the early part of the 20th century, the educationalist Maria Montessori advocated the use of shapes and colours to introduce grammar to children in an interactive, multimodal way (Montessori, 1918), although this was not an intervention for children with language difficulties but an approach to be used with all. Since then there have been other systems devised using shapes or colours to code parts of speech (Lea, 1965; Lea, 1970; Conn, 1973; Bryan, 1997; Kaldor, 2001), designed specifically to support children with language impairment.

Colourful Semantics (Bryan, 1997) is one system that has been explored with regards to its efficacy in developing the language of CWAD. A Sri Lankan study (Hettiarachchi and Ranaweera, 2019) of 30 participants found that when used as a whole class programme, primary school aged CWAD made good progress in their understanding of wh- questions and in their ability to give appropriate responses. However, the authors themselves admit that this study is the only published research

paper on the use of Colourful Semantics with CWAD and that further research is necessary to corroborate their findings.

2.5.3 The SHAPE CODING™ System

The SHAPE CODING™ System was developed by Dr Susan Ebbels as a response to the limitations of existing visual codes and methods (Ebbels, 2007). It uses colours to code at word level (see Table 4), shapes to code at phrase level (see Figure 1), and arrows or lines to indicate verb morphology (see Figure 2).

Table 4: Parts of speech and their colours

Part of Speech	Example	Colour
Noun/Pronoun	man, she, box	Red
Determiner/Possessive pronoun	the, his, a	Pink
Verb	walk, read	Blue
Adjective	big, happy	Green
Preposition	on, under	Yellow
Adverb	slowly, loudly	Brown
Coordinating conjunction	and, but	Purple
Subordination conjunction	because, although	Orange

Figure 1: Phrases and their shapes
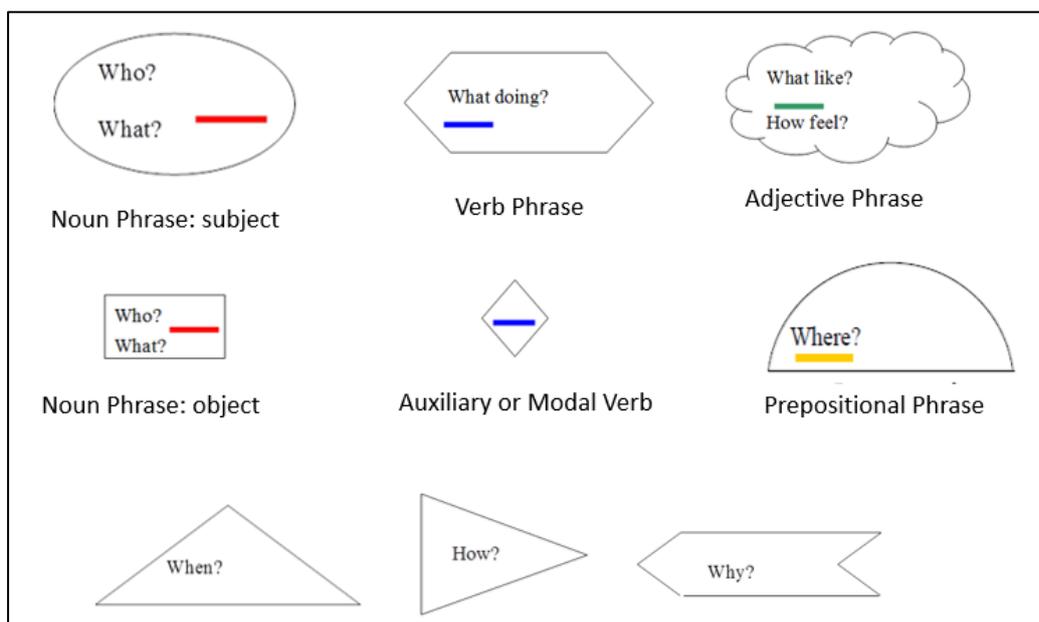
Figure 2: Lines to show tenses and aspects
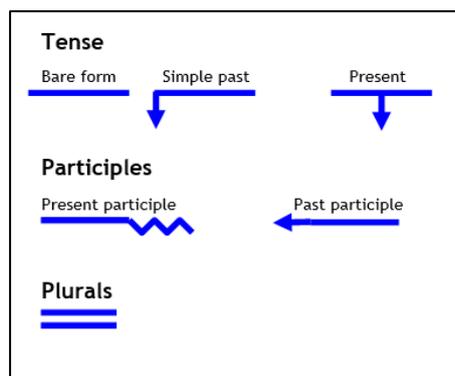
Shapes can be placed inside other shapes to demonstrate the hierarchy of language, and moved around to show how questions and passive sentences are formed (Ebbels, 2007). Only those parts of the SHAPE CODING™ System that are necessary to the rule being taught are used, to prevent over complication and confusion (Ebbels, 2007).

2.5.3.1 The use of the SHAPE CODING™ System with Deaf children

Since its inception, there has been a range of research examining the efficacy of the SHAPE CODING™ System. Of the 14 studies published, 8 studies relate to individuals with Developmental Language Disorder (or Specific Language Impairment as it is referred to in older research papers). 4 studies relate to individuals with language impairment, 1 to children with complex needs and 1 to adults with aphasia. The research has also covered a wide age range, from 5 year olds to adults. All studies involving children, with the exception of Kulkarni et al. (2014), found that statistically significant progress was made at group level with expressive and receptive language structures. The adult study (Newton et al, 2017) showed some progress, but results did not meet statistical significance. It is important to remember that Newton's study is the only one examining an adult demographic and more research is required in this area.

Given the body of research, it can be stated that The SHAPE CODING™ System has been shown to be a highly effective system for improving the language of children and adolescents (Calder et al., 2020; Ebbels et al., 2014). However, there has of yet been no published studies examining the use of the SHAPE CODING™ System with CWAD, although it is known to be used in some educational settings (McAleer, 2011). Given that the features of CWAD writing are markedly similar to

children with language disorder it is firstly surprising that there is no current published research, and secondly vital that research is completed to show, as this researcher believes, that the SHAPE CODING™ System is a valuable resource to support the language development and writing abilities of CWAD.

2.6 Hypotheses

Three hypotheses are therefore put forward for this study:

1. There will be a statistically significant difference between the CWAD's results on the pre-intervention writing assessment and the post-intervention writing assessment.

2. There will be a statistically significant difference between the CWAD's enjoyment of writing and perception of themselves as a writer, pre-intervention and post-intervention.

3. There will be a statistically significant difference between the staff's perception of CWAD enjoyment of writing and ability to write, pre-intervention and post-intervention.

2.7 Conclusion

The existing body of literature points to a pattern of low attainment with regards to the writing of CWAD. There are very few studies that have researched the efficacy of writing interventions, and those that have been trialled have had varying degrees of success. It is clear that there is still more work to do in developing techniques for teaching CWAD to write cohesively and to an age appropriate level. However, as Knoors & Marschark (2014) point out, while new methods for teaching CWAD are regularly put forward as a solution to low literacy attainment, the heterogeneous nature of deafness means that there can be no one 'fix all' intervention. It is hoped that with the above hypotheses proved to be true, the SHAPE CODING™ System can add to the toolkit for teachers and educators in order to support CWAD in making the progress that they are capable of, and deserve, to make.

3. Methodology

3.1 Introduction

'Research is central to the concept of teaching as a profession' (Atkins & Wallace, 2012: 12), with the aim always to improve the effectiveness of practise in order to provide the best support and learning opportunities for students. An action research framework was used to conduct this study, with the research questions being:

1. How far can a visual coding system, i.e. the SHAPE CODING™ System, impact upon the writing skills of CWAD?
2. To what extent can the use of a visual coding system, i.e. the SHAPE CODING™ System, improve CWAD's confidence when writing?

3.2 Design

3.2.1 Action Research

There are many different design frames that can be used for research (Thomas, 2017) and after consideration it seemed that this study could either be completed through the use of action research or evaluation research. These approaches are compared in Table 5.

Table 5: A comparison of Action Research vs. Evaluation Research (Thomas, 2017)

Action Research	Evaluation Research
• Undertaken by the practitioner implementing the change or innovation. • Research is done while the change or innovation is happening. • Emphasis on problem solving • A cyclical process – the practitioner continually reflects and revises the process.	• Undertaken by an independent researcher • Research is done after the change or innovation has happened. • No assumption that conclusions drawn from the research feeds back into the innovation. • A linear process – the researcher assesses the effectiveness of the innovation before, during and after the designated time period.

Evaluation research is more suited to, and more often used with, large scale research projects (Thomas, 2017), whereas action research lends itself to small scale studies (Denscombe, 2017). Furthermore, while evaluation research can be used to assess the impact of an educational intervention, action research offers more opportunity for reflection and adaptation within the intervention process itself. The founder of action research, Karl Lewin, described it as a spiral of planning, action, reflection and refinement (1946) which better fits a project wherein the researcher is also the practitioner and is able to make changes as results are obtained. Having a level of flexibility was important for this project, as it ensured that lessons were always pitched at the right level, enabling CWAD to make the maximum amount of progress possible using the SHAPE CODING™ System. Action research also focuses on aspects of the researcher's personal practise, with the overall aim to share the results with fellow practitioners (McNiff, 2016).

For these reasons, action research seemed the more suitable design frame on which to build this study. It can be difficult, however, for practitioners to remain objective

when results of the research may challenge personal views or pedagogies (Bell & Waters, 2018) and therefore data was taken from a range of sources in order to triangulate and confirm findings.

3.2.2 Multiple Case Study

Within the action research framework, a multiple case study approach was used. Case studies enable the researcher to explore the subject in greater depth (Denscombe, 2017), although the small sample meant that it was not possible to extrapolate the results to a wider population (Thomas, 2017). To partly compensate for this, multiple case studies were used. While still a restricted sample, studying a number of children, rather than just one, is more representative of the heterogenous nature of CWAD and thus increased the external validity (Thomas, 2017). Generalisations will still have limitations, but a multiple case study can be used as a 'starting point' for research (Denscombe, 2017). Given that there is not yet any research surrounding the use of the SHAPE CODING™ System to support the writing of CWAD, this is a good foundation on which to build the body of research.

3.2.3 Triangulation

'The key to triangulation is to see the same thing from different perspectives and thus be able to confirm or challenge the findings of one method with those of another' (Laws et al., 2013:143). Both qualitative and quantitative data have therefore been used in this study in order to produce the most complete research possible (Bell & Waters, 2018).

Quantitative research concerns itself with the relationships and patterns within numeric data (Thomas, 2017). It is precise, results are repeatable and easy to present clearly (Denscombe, 2017). However, quantitative analysis is more effective when large amounts of data are involved (Denscombe, 2017), which in a small scale study is not the case. It is also not true that numerical data is necessarily more objective as statistics can be manipulated or presented according to the bias of the researcher (Denscombe, 2017).

Qualitative research surrounds the collection of data in the form of words (Denscombe, 2017) and often comes from observations or interviews (Thomas, 2017). It has advantages for case studies in that data can be detailed and in-depth.

Its non-binary nature also allows for ambiguity or multiple explanations of results (Denscombe, 2017). Generalisation is not easy though, as written or oral data is much less repeatable than numerical data, and results are easier to take out of context when quoting or reporting (Denscombe, 2017).

Thomas states that while qualitative and quantitative data differ, they are by no means incompatible and can in fact complement each other (2017). This research made use of writing samples and questionnaires to provide both qualitative and quantitative data to increase the validity and reliability of the study. While both methods have flaws, not relying on one type of data should overcome the disadvantages that each have, although it is recognised that researcher bias plays a part in all data analysis and is acknowledged in this study.

3.3 Participants

The participants were selected through convenience sampling. While convenience samples can provide problems with generalisation, as they will not be a truly random sample representative of the whole population (Bryman, 2012; Thomas, 2017), COVID restrictions meant that the researcher was only able to complete interventions with pupils from within their own setting. A convenience sample was therefore the only viable option for this study. An additional advantage to this was that the researcher was known to the participants, which meant that they were all comfortable and willing to complete the intervention. Bryman (2012) also points out that convenience sampling can be useful in providing initial research with which to form the basis of further studies.

The participants for the study were eight children who are deaf (CWAD) from school years 2-6 (6yrs-11yrs) all of whom attend the same mainstream school with specialist resource base. This is the case for 6% of school age CWAD across the UK (CRIDE, 2019). Normally, CWAD would be taught in the resource base for Maths, Reading and Writing (along with specialist interventions such as Speech and Language Therapy), and are then integrated into their mainstream class for foundation subjects (Science, History, Geography, Art/DT, Music, Computing, PE). However, due to COVID-19, mixing with multiple classes was not allowed and during

the period of the intervention, CWADs were educated exclusively within the resource base 'bubble'.

The resource base uses a Total Communication (TC) approach with regards to communication in order to accommodate the variety of communication methods and family backgrounds of its pupils. This means that both speech and sign are used, along with any other method that might support the pupil, such as pictures or gesture. CWAD are encouraged to make maximum use of their residual hearing through the use of their hearing equipment and additional technology such as Assistive Listening Devices (ALD). Lessons are both spoken and signed, using BSL or SSE depending on the needs of the CWAD, both in the resource base and in the mainstream classes. It is important to ensure that all children attending the school have their communication needs met (NDCS, 2020), whether that be through oral/aural methods, sign language, or the use of both.

Information about each CWAD can be found in Table 6. Two Specialist Teaching Assistants (STA), who work closely with the CWAD involved in the study, also participated through completion of pre- and post-intervention questionnaires.

Pupil	Year group	Type and degree of Deafness	Amplification used	Communication method	SEN	EAL
A	2	Bilateral severe-profound sensorineural	CI – Cochlear Nucleus 7	TC	None	Yes – Lithuanian
B	2	Bilateral moderate-severe mixed with microtia and atresia	BAHA – Oticon Ponto 3 SP	Oral/Aural	None	No
C	3	Bilateral severe-profound sensorineural	CI – AB Naida	TC	None	No
D	3	Bilateral severe sensorineural	HA – Phonak Sky V70 UP	TC	None	No
E	4	Bilateral profound sensorineural	HA – Phonak Sky V70 UP	BSL	None	No
F	5	Bilateral profound with microtia and atresia	CI – AB Neptune	BSL	Core Autism ADHD	No
G	5	Bilateral profound sensorineural	CI – AB Naida	TC	Undiagnosed learning difficulties	Yes – Punjabi
H	6	Bilateral mild-profound (sloping) sensorineural	HA – Phonak Sky Q70 SP	TC	None	Yes – Slovak/Romani

While only a small number of children participated in this study, it still can be considered a representative sample of CWAD due to the range of amplification technology used, proportion of CWAD who have English as an additional language (EAL), and proportion of CWAD who have additional Special Educational Needs (SEN). 25% of the sample have EAL, compared to 13% nationally (CRIDE, 2019). 12.5% of the sample have additional diagnosed SEN, compared to 22% nationally

(CRIDE, 2019), although this rises to 25% if suspected needs are included. The major difference, however, is that all participants in this study, and indeed in the resource base, have severe to profound hearing loss. This is significantly higher than the 21% of children across the UK (CRIDE, 2019) and therefore generalisations should only be made for children with similar audiological profiles. Further study will be necessary to establish whether results can be extrapolated further across all CWAD.

3.4 Ethics

Ethical approval for the study was granted by the University of Hertfordshire (see Appendix 1), following BERA guidelines (2018). The approval protocol number for this project is EDU/PGT/CP/05296. All evaluated data was historic, collected as part of the researcher's routine work as a Qualified Teacher of the Deaf (QToD) and therefore individual consent forms were not needed. However, permission to access this data was sought and gained from the researcher's employer. All data was held securely by the researcher, in compliance with GDPR regulations, University of Hertfordshire ethics, and the researcher's school regulations.

3.5 Data Collection

Data has been mined from routinely collected assessments and staff and pupil voice questionnaires. Both assessments and questionnaires are collated three times per academic year in line with the school assessment cycle.

3.5.1 Writing intervention

The intervention was a 12 week block of writing lessons using the SHAPE CODING™ System (Ebbels, 2007) to teach grammatical structures, with a focus on subject-verb-object word order, prepositions, and noun-verb agreement including is/are/was/were. CWAD completed a range of writing activities over the intervention period, all with the use of the SHAPE CODING™ System to teach, support and develop written grammar. Various texts were used as stimuli for writing, including 'The Dragon Machine' by Helen Ward (2003) and an Usborne adaptation of 'The

Jungle Book' by Rudyard Kipling (Lloyd Jones, 2019). Examples of writing can be found in Appendix 5.

The participant CWAD completed activities such as:

- Sorting and identifying words by their grammatical class, using the SHAPE CODING™ System colours.
- Forming correct sentence structures using the SHAPE CODING™ System shapes.
- Creating sentences using the SHAPE CODING™ System shapes.
- Shared (adult-led) writing. This is where the teacher creates an example text with the class, demonstrating how to structure a piece of writing. Pupils are encouraged to share their ideas and sentences, with the adult modelling how to correct mistakes or improve the text.
- Independent writing, where pupils are given the opportunity to practise writing taught sentence structures themselves. Adults support where necessary and children are encouraged to correct errors following feedback.

Expertise of the teacher is vital when delivering interventions. Studies delivered by teachers trained in the technique they are using (e.g. Berent et al., 2007) have stronger results than those where the teacher is not an expert (Strassman & Schirmer, 2015). The researcher for this study has been trained in the SHAPE CODING™ System, having completed both Part 1 and Part 2 courses, and has access to resources made by Susan Ebbels, creator of the system.

3.5.2 Writing Samples

It is important that writing samples are collected, in order to add to the evidence base for CWAD writing and to prove efficacy of the intervention (Williams & Mayer, 2015). 70% of the studies analysed in Williams & Mayer's research (2015) did not contain an evidence base of CWAD writing, which weakens any claims that the interventions used had a positive impact.

The Oxford Analytical Writing Assessment (Burman et al., 2008) has been used in this study in order to track progress with writing. It was created for children with

profound hearing loss and the design is discussed more fully in Section 3.6.1. CWAD are shown a four-picture sequence (see Figure 3) and asked to write a corresponding narrative. The picture sequence is discussed with the CWAD prior to writing, in order to ensure that they understand what is happening in each picture as this is an assessment of writing rather than comprehension. Children are also allowed to ask for help with spelling, as per the assessment guidelines. The same stimulus pictures are used for every assessment in order to ensure that the writing samples are directly comparable.

Figure 3: Stimulus pictures from the Oxford Analytical Writing Assessment. Numbers have been added by the researcher for clarity. ©Terezinha Nunes 2010.
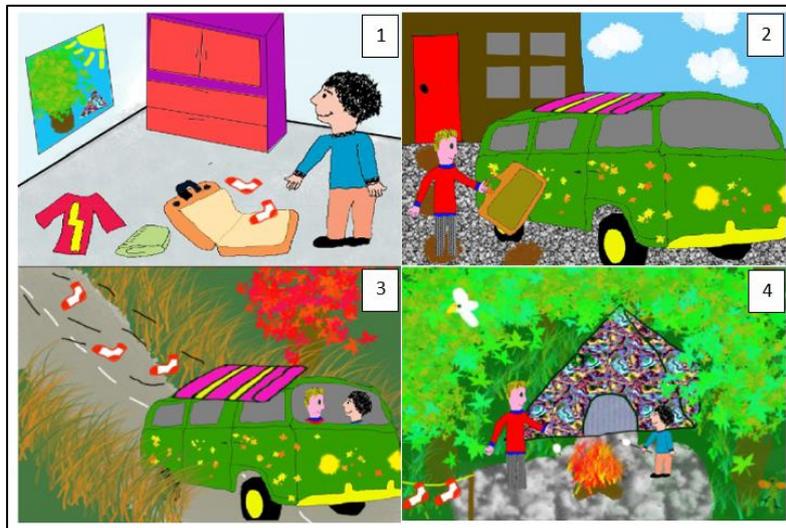
3.5.3 Pupil and Staff Questionnaires

Pupil and staff voice was collected through a questionnaire (see Appendix 2). A 0-10 Likert scale (Denscombe, 2017; Thomas, 2017) was used in order to measure how far the participants agreed or disagreed with eight statements around pupil attitudes to writing, and an open answer question at the end gave CWAD and staff the opportunity to give their opinions unbound by the researcher's ideas or theories (Thomas, 2017). Written questionnaires can pose difficulties for CWAD with poor literacy levels – the participants must be able to understand the questions asked of them (Denscombe, 2017) – and therefore the researcher completed the questionnaire with each CWAD, reading each statement and offering further explanation if needed. While this has the potential for the researcher to influence the answers given by the CWAD, every attempt was made not to prompt answers and in

fact it is more likely that the answers given are more accurate for this support, as the CWAD would therefore give true reflections of their beliefs and attitudes rather than responding based on a guess or a misunderstanding. Post-intervention questionnaires were completed without reference to the pre-intervention questionnaires and so there was no opportunity to influence the responses in light of earlier answers.

3.6 Data Analysis

3.6.1 Oxford Analytic Writing Assessment

The pre- and post-intervention writing samples were analysed using the Oxford Analytic Writing Assessment (Burman et al., 2008). This is a two-part analysis, with the first part focused on grammatical attainment and the second focused on the content of the writing. A four-point scale is used to assess each characteristic (see Appendix 3). This enabled the data to be assessed quantitatively, as well qualitatively using extracts from the writing samples.

This assessment was created in response to a lack of suitable assessments for profoundly deaf children, with the researchers identifying a significant floor effect in other writing assessments where the criteria was of too high a level, or the steps of progress too large, for the majority of primary-aged CWAD (Burman et al., 2008). The Oxford Analytic Assessment comprises of small steps that cover the areas of writing that CWAD often find difficult, with the original study (Burman et al., 2008) involving primary-aged CWAD with severe-profound hearing loss, educated in schools for the Deaf or as part of resource provisions in mainstream schools. This is the same demographic that was used in this study, and so the Oxford Analytic Writing Assessment is an ideal tool for analysing the writing of the cohort in this study. The assessment also has good test-retest reliability, with Burman et al. (2008) finding a Pearson r correlation score of 0.82. It also can be used easily by teachers without having to complete any specific training. The assessment is not standardised but does identify strengths and weaknesses of CWAD, as well as track progress when used regularly. To ensure accurate analysis, the researcher moderated the writing samples with QToD colleagues, with each QToD marking the assessments

individually and then agreeing a final score based on the average of all professionals.

As this assessment is used routinely with the CWAD at the researcher's school, there has also been data collected after the post-intervention assessment. This is useful to analyse as it shows the longer-term effect of the intervention.

3.6.2 Pupil and Staff Questionnaires

Staff and pupil questionnaires were analysed quantitatively, with the Likert scale providing numerical data. Data was triangulated with the quantitative and qualitative data obtained from the writing samples to ensure a complete picture of pupil progress (Bell & Waters, 2018). The questionnaires showed the impact of the intervention on CWAD's confidence and perception of their writing abilities, as well as staff's perception of their key pupils' confidence and writing abilities.

3.7 Limitations

As with any research, this study has its limitations. Firstly, the number of participants, 8, is small. This is in common with many studies involving CWAD (Williams & Mayer, 2015) but was impacted more severely by the restrictions imposed by the COVID-19 pandemic. There are also currently no published studies of the use of the SHAPE CODING™ System with CWAD and therefore there is no research base with which to compare or corroborate the findings of this study. Replication of the research will be necessary in order to generalise the findings more widely across the CWAD population.

3.8 Reflexivity

It is important to acknowledge the influence that attitudes, principles, beliefs and prejudices can have on research (Atkins & Wallace, 2012). Denscombe describes it as 'insider knowledge' (2017:133) that can affect the impartiality of data, or can even mean that the researcher misses useful information due to overfamiliarity with the setting or participants. In order to ensure academic integrity, the researcher's interests should be clearly identified.

The researcher for this study is the lead QToD of a specialist resource base within a mainstream primary school and is responsible for the progress of CWAD. Jointly with a QToD colleague, the researcher teaches reading, writing and maths to the cohort and ensures accessibility and appropriate support when CWAD attend lessons in their mainstream classes. Closing the attainment gap between CWAD and their hearing peers is a large focus of the researcher's work, and they are therefore interested in developing interventions that successfully support accelerated progress.

3.9 Conclusion

This study used an action research framework, through multiple case studies and triangulation of qualitative and quantitative data, in order to identify the impact of the SHAPE CODING™ System on the writing of CWAD. Data was collected in the form of writing samples, analysed using the Oxford Analytic Writing Assessment, a specialist tool designed for use with CWAD, and questionnaires to explore pupil and staff voice. While there are inevitable limitations to the study, all efforts have been made to make the research as reliable as possible.

4. Results

Results for this study have been taken from pre- and post- intervention writing assessments and pre- and post- intervention questionnaires. The writing samples have been analysed for overall impact on writing, as well as for impact on specific grammatical structures. Questionnaires have been analysed to identify the impact of the intervention on CWAD confidence and enjoyment of writing, both from the perspective of the CWAD and that of the STAs working with them.

As not all the data variables met the criteria for normal distribution on the Shapiro Wik test, a non-parametric test (the Wilcoxen Signed Rank Test) was used to identify whether or not the changes in scores pre- and post-intervention were statistically significant.

4.1 Oxford Analytic Writing Assessment (total scores)

Each element of the assessment was scored on a five-point scale, indicating how frequently and accurately it appeared in the writing sample (see Appendix 3). As the assessment includes both grammar and narrative skills, the total scores and the scores for grammatical elements only, have been analysed separately. The full writing samples for the assessments can be found in Appendices 4 and 6.

4.1.1 Total scores

Total scores for both the pre- and post-intervention assessments can be found below in Table 7 and descriptive statistics for this variable are displayed in Table 8.

Table 7: Oxford Analytic Writing Assessment total scores

	Pre-intervention score (out of 64)	Pre-intervention score (%)	Post-intervention score (out of 64)	Post-intervention score (%)
Child A	23	35.94	30	46.88
Child B	29	45.31	47	73.44
Child C	15	23.44	28	43.75
Child D	26	40.63	45	70.31
Child E	15	23.44	29	45.31
Child F	14	21.88	26	40.63
Child G	40*	62.50*	42	65.63
Child H	35	54.69	45	70.31

This score is taken from March 2020, as the child was absent for the September assessment. Due to the COVID-19 situation, no formal assessment was completed between March 2020 and September 2020.

Table 8: Descriptive statistics – total score

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Total Score (out of 64) pre-intervention	8	14	40	24.63	9.753
Total Score (out of 64) post-intervention	8	26	47	36.50	8.992

Pre-intervention, the raw scores ranged from 14/64 to 40/64, thereby showing that this was a suitable assessment for the CWAD – all students scored and none were at ceiling level. The post-intervention raw scores had a range of 26/64 - 47/64. Again, no students were at ceiling level which indicates that the assessment remained suitable and could accurately show progress.

4.1.2 Comparison of total scores

The total scores are compared in the bar graph below (Figure 4), which displays pre- and post-intervention assessment scores for each participant CWAD.

Figure 4: Comparison of pre- and post-intervention total writing scores
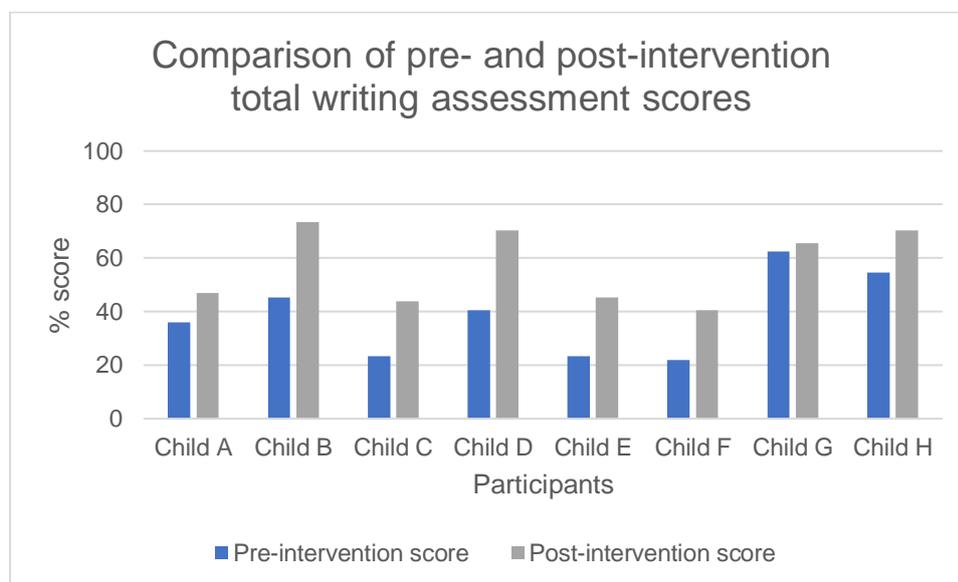
Figure 4 shows that all CWAD achieved higher scores post-intervention than they did pre-intervention. A Wilcoxen Signed-Rank Test showed that the increase was statistically significant when comparing the total test score post-intervention to the total test score pre-intervention, z=2.521, n=8, p=0.012, with a large effect size (r=0.63). The median total test score rose from 24.5 pre-intervention to 36.0 post-intervention. This refutes the null hypothesis that the median of differences equals 0.

4.2 Oxford Analytic Writing Assessment (grammatical structures scores)

In order to identify the impact that the intervention had on written grammar, analysis has been completed on data specifically for the grammar elements of the Oxford Analytic Writing Assessment. These are items 1, 2, 3, 4, 5, 7, 9, 10 and 12 on the assessment sheet (see Appendix 3).

4.2.1 Grammatical structures scores

Scores for the grammatical structures, both pre- and post-intervention, can be found in Table 9. Descriptive statistics for this variable are shown in Table 10.

Table 9: Oxford Analytic Writing Assessment grammatical structures scores

	Pre-intervention score for grammatical structures (out of 36)	Pre-intervention score for grammatical structures (%)	Post-intervention score for grammatical structures (out of 36)	Post-intervention score for grammatical structures (%)
Child A	17	47.22	22	61.11
Child B	24	66.67	32	88.89
Child C	11	30.56	20	55.56
Child D	20	55.56	31	86.11
Child E	7	19.44	14	38.89
Child F	8	22.22	14	38.89
Child G	23	63.89	25	69.44
Child H	27	75.00	30	83.33

Table 10: Descriptive statistics – grammatical structures

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Grammatical structures score pre-intervention	8	7	27	17.13	7.661
Grammatical structures score post-intervention	8	14	32	23.50	7.251

The pre-intervention grammatical structures score had a range of 7/36 – 27/36. This is a wide range, but still within the scope of the assessment. The participant CWAD did not rank in the same order for grammatical structures as they did for total scores, however it was true that Children A, C, E and F had lower scores for both total score and grammatical structures scores, while Children B, D, G and H had higher scores.

The post-intervention grammatical structures score had a range of 14/36 – 32/36. The minimum score on the assessment was double that of the minimum score pre-intervention.

The data for grammar structures is broken down in Table 11 and Table 12, which display the scores given for each structure. This identifies the strengths and weaknesses of each CWAD, as well as the cohort as a whole. Comparison of the

pre- and post-intervention scores shows the impact that the intervention had on CWAD use of specific grammatical structures.

	Child A	Child B	Child C	Child D	Child E	Child F	Child G	Child H	Total
Subject-verb order	3	3	2	4	0	1	4	4	21
Noun/verb phrases	2	3	1	2	1	1	3	4	17
Prepositions	1	3	1	1	0	1	1	2	10
Articles 'the' and 'a'	2	3	1	2	0	0	3	3	14
Connectives	1	2	1	1	1	1	2	2	11
Verb tenses	1	1	0	1	0	0	3	2	8
Substitutions or omissions	1	3	0	3	0	0	1	3	11
Unnecessary words/morphemes	4	4	4	4	4	4	4	4	32
Pronouns	2	2	1	2	1	0	2	3	13
Total score	17	24	11	20	7	8	23	27	137

Table 11: Scores for the grammar elements of the Oxford Analytic Writing Assessment - pre-intervention

Table 11 shows that the strongest area for the participant CWAD writing pre-intervention was unnecessary words or morphemes. This means that CWAD were not adding extra words or letters to sentences. Verb tenses and prepositions had the lowest score, showing that these were structures that CWAD were either not including in their writing or were not able to use them correctly.

Table 12: Scores for the grammar elements of the Oxford Analytic Writing Assessment - post-intervention

	Child A	Child B	Child C	Child D	Child E	Child F	Child G	Child H	Total
Subject-verb order	3	4	3	4	2	2	4	4	26
Noun/verb phrases	2	4	3	4	2	1	4	4	24
Prepositions	2	4	2	4	1	1	2	3	19
Articles 'the' and 'a'	3	4	2	4	1	2	3	4	23
Connectives	2	3	2	2	2	1	2	2	16
Verb tenses	2	2	2	3	1	1	2	3	16
Substitutions or omissions	1	4	1	3	0	0	3	3	15
Unnecessary words/morphemes	4	4	3	4	3	4	3	4	29
Pronouns	3	3	2	3	2	2	2	3	20
Total score	22	32	20	31	14	14	25	30	188

Post-intervention, the highest scoring element remained unnecessary words and morphemes, although subject-verb order was also very strong post-intervention (see

Table 12). Substitutions and omissions was the biggest area of weakness for CWAD, meaning that words were missing from sentences e.g. the boy shirt in the suitcase. Verb tenses also remained an area that CWAD found more difficult but the score for tenses did double, from a score of 8 out of a possible 32 pre-intervention, to 16 out of 32 post-intervention, showing improvement.

4.2.2 Comparison of grammatical structures scores

Figure 5 compares the scores for grammatical elements pre- and post-intervention. The grammatical structures that showed the greatest improvement were prepositions and articles ('the' and 'a') but there was also significant improvement in verb tenses. There was a reduction in the score for unnecessary morphemes, however this was because in the initial assessment, some CWAD writing samples were too short to be deemed to have included extra words. Following the intervention, CWAD produced longer writing samples and therefore unnecessary words or morphemes became evident.

Figure 5: Comparison of scores for each grammatical element pre- and post-intervention
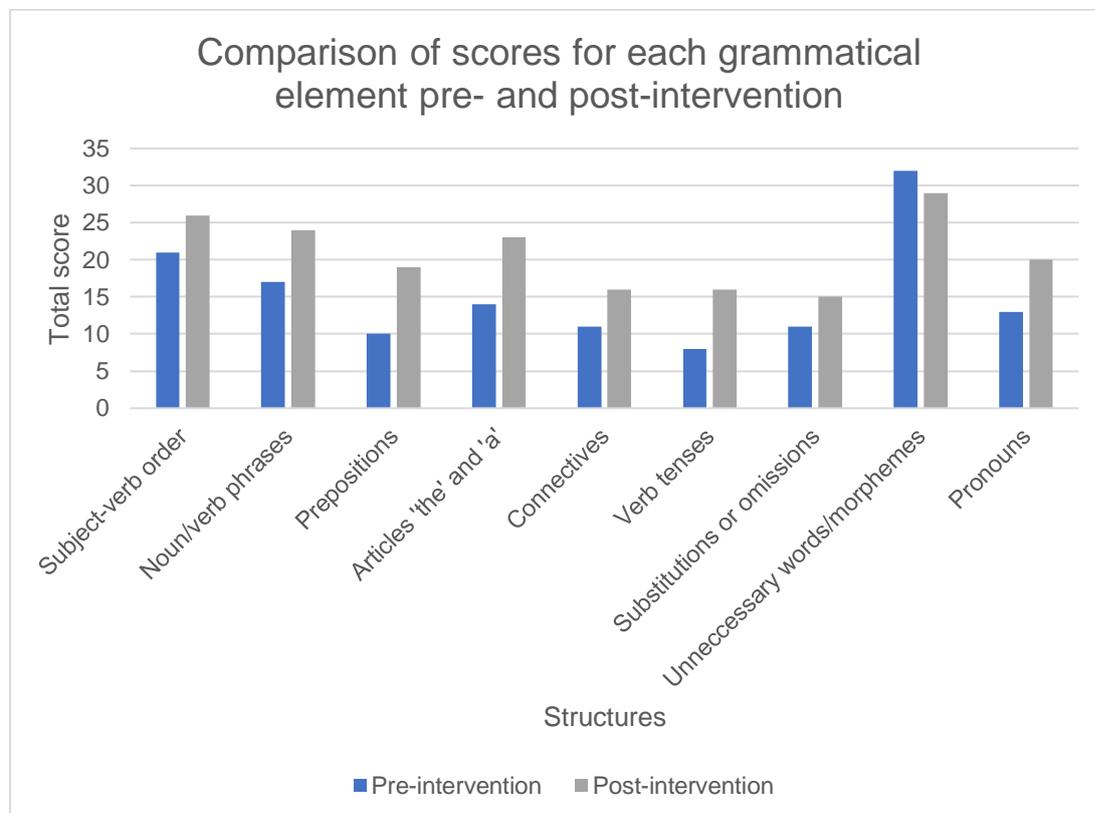
The bar graph in Figure 6 compares the pre- and post-intervention grammatical elements scores for each participant CWAD.

Figure 6: Comparison of pre- and post-intervention grammatical elements scores by child
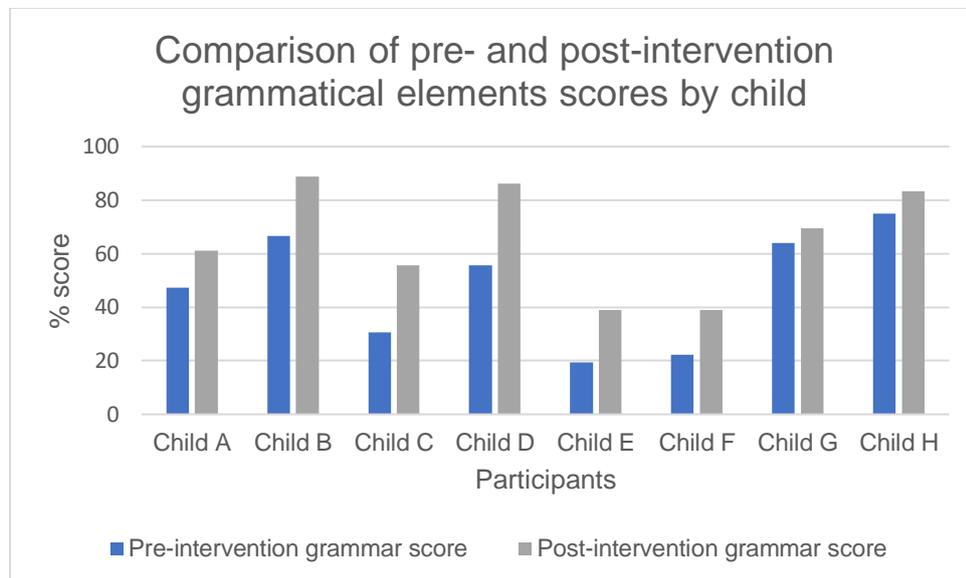
A Wilcoxen Signed-Rank Test showed a statistically significant increase in the grammatical elements score post-intervention when compared to the pre-intervention grammatical elements score, $z=2.521$, $n=8$, $p=0.012$, with a large effect size of $r=0.63$ (Cohen, 1988). The median total test score rose from 18.5 pre-intervention to 23.5 post-intervention. This means that the null hypothesis can be rejected.

4.3 Pupil voice

Initial questionnaires were completed in September 2020, with the exception of Child E who was absent from school during that period and did not complete a questionnaire until the end of the intervention. Follow-up questionnaires were completed in March 2021. Responses were given via a Likert scale of 0-10, with 0 being completely disagree (indicated by a sad face) and 10 being completely agree (indicated by a happy face).

4.3.1 Pupil voice pre-intervention

Table 13 shows individual responses to the pre-intervention questionnaire, along with the average score for each statement. Descriptive statistics can be found in Table 14.

Table 13: CWAD responses to the pre-intervention questionnaire

	Child A	Child B	Child C	Child D	Child E	Child F	Child G	Child H	Average Score
I enjoy writing at school.	5	5	0	5	N/A	10	6	10	5.86
I enjoy writing at home.	5	5	0	5	N/A	10	5	10	5.71
I think I'm a good writer.	10	10	5	8	N/A	9	9	5	8.00
It's easy to think of things to write.	5	6	5	5	N/A	5	5	10	5.86
I like to read my writing to other people.	5	8	5	5	N/A	7	10	5	6.43
I can get frustrated when I'm writing.	10	10	10	10	N/A	9	5	10	9.14
I get nervous when it's time to write.	0	9	5	3	N/A	10	0	5	4.57
I feel confident asking for help during writing time.	0	9	10	5	N/A	10	5	10	7.00

Table 14: Descriptive statistics - pupil voice pre-intervention

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
I enjoy writing at school	7	0	10	5.86	3.436
I enjoy writing at home	7	0	10	5.71	3.450
I think I'm a good writer	7	5	10	8.00	2.160
It's easy to think of things to write	7	5	10	5.86	1.864
I like to read my writing to other people	7	5	10	6.43	1.988
I can get frustrated when I'm writing	7	5	10	9.14	1.864
I can get nervous when it's time to write	7	0	10	4.57	3.952
I feel confident asking for help during writing time.	7	0	10	7.00	3.830

The average scores show that most pupils felt that they were good writers, but also expressed that they felt nervous when they had to write in lessons.

4.3.2 Pupil voice post-intervention

Table 15 shows individual responses to the post-intervention questionnaire, along with the average score for each statement. Descriptive statistics can be found in Table 16.

Table 15: CWAD responses to the post-intervention questionnaire

	Child A	Child B	Child C	Child D	Child E	Child F	Child G	Child H	Average Score
I enjoy writing at school.	9	8	6	10	4	10	10	9	8.25
I enjoy writing at home.	5	10	2	9	7	10	3	3	6.13
I think I'm a good writer.	10	10	5	7	10	8	9	7	8.25
It's easy to think of things to write.	7	7	1	8	5	2	7	5	5.25
I like to read my writing to other people.	6	10	4	10	9	4	10	10	7.88
I can get frustrated when I'm writing.	10	9	8	8	7	10	6	10	8.50
I get nervous when it's time to write.	10	10	6	10	5	7	10	10	8.50
I feel confident asking for help during writing time.	10	10	7	10	10	10	8	8	9.13

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
I enjoy writing at school	8	4	10	8.25	2.188
I enjoy writing at home	8	2	10	6.13	3.314
I think I'm a good writer	8	5	10	8.25	1.832
It's easy to think of things to write	8	1	8	5.25	2.550
I like to read my writing to other people	8	4	10	7.88	2.748
I can get frustrated when I'm writing	8	6	10	8.50	1.512
I can get nervous when it's time to write	8	5	10	8.50	2.138
I feel confident asking for help during writing time.	8	7	10	9.13	1.246

Post-intervention, CWAD reported high levels of confidence with their writing. They also noted a lack of nervous feelings, in contrast to the pre-intervention data.

4.3.3 Comparison of pupil voice scores

The pre- and post-intervention pupil voice scores are compared in the bar graph below (Figure 7) The average score for most of the questionnaire statements increased, showing that pupils felt themselves to be better writers following the intervention. The best impact was on pupil nervousness but there was also a significant increase in CWAD enjoyment of writing in school, as well as their confidence to ask for help. Two areas showed a decrease in scores – finding it easy to think of ideas, and feelings of frustration when writing.

CWAD self-perception of writing skills

Statements (vertical axis), Average score (horizontal axis, 0.00 to 10.00)

- I enjoy writing at school
- I enjoy writing at home
- I think I'm a good writer
- It's easy to think of things to write
- I like to read my writing to other people
- I can get frustrated when I'm writing*
- I get nervous when it's time to write*
- I feel confident asking for help during writing time

Legend: ■ Pre-intervention ■ Post-intervention
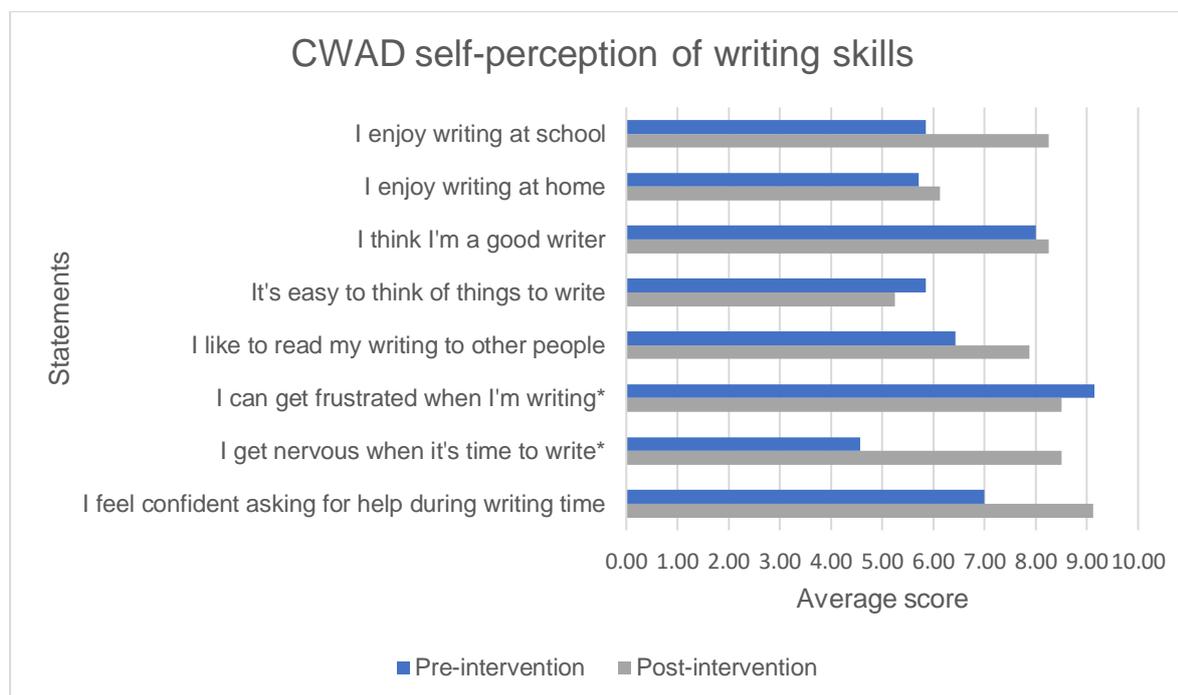
A Wilcoxen Signed-Rank Test showed a statistically insignificant increase in total pupil questionnaire scores, pre- and post-intervention, z=1.352, n=7, p=176, with a medium effect size of r=0.34 (Cohen, 1988). This means that the null hypothesis should be retained. The median total test score did rise however, from 46.0 pre-intervention to 62.5 post-intervention.

4.3.4 Pupil perceptions of useful writing strategies

Tables 17 and 18 show that while CWAD remained reliant on adult support as a strategy to support their writing, the use of the SHAPE CODING™ System featured more heavily in discussion post-intervention. CWAD recognised that it was a useful strategy to support writing.

Table 17: Pre-intervention answers to the question 'What helps you when you are writing?'

	Number of CWAD citing the method of support
Adult support	4
Don't know	2
Shape Coding	1
School spelling support tool	1

Table 18: Post-intervention answers to the question 'What helps you when you are writing?'

	Number of CWAD citing the method of support	Notes
Adult support	7	
Shape Coding	6	One child stated that he did not like using shapes as it was difficult. One child mentioned using the word wall. This displays key vocabulary sorted into their Shape Coding shapes and colours.
School spelling support tool	2	

4.4 Staff Voice

The STAs who support the participant CWAD in writing sessions were asked to complete one questionnaire per child that they support. As with the pupil questionnaires, responses were given in the form of a 0-10 Likert scale with 0 as completely disagree (indicated by a sad face) and 10 as completely agree (indicated by a happy face). As with the pupil voice questionnaires, questionnaires were completed in September 2020 and March 2021.

4.4.1 Staff voice pre-intervention

Table 19 shows individual responses to the post-intervention questionnaire, along with the average score for each statement. Descriptive statistics can be found in Table 20.

Table 19: Staff responses to the pre-intervention questionnaire

	Child A	Child B	Child C	Child D	Child E	Child F	Child G	Child H	Average Score
My pupil enjoys writing at school.	2	4	1	3	7	1	1	8	3.38
My pupil is a good writer.	3	4	1	3	1	1	2	3	2.25
My pupil finds it easy to think of things to write.	2	3	1	2	1	1	1	3	1.75
My pupil likes to share their writing with other people.	3	4	2	4	9	9	0	6	4.63
My pupil can get frustrated when they are writing.	2	4	1	3	9	10	9	2	5.00
My pupil gets nervous when it's time to write.	1	5	1	4	8	9	9	6	4.63
My pupil feels confident asking for help during writing time.	4	4	1	2	3	2	1	2	2.38
I feel confident in knowing how to develop my pupil's writing skills.	4	6	4	3	2	2	3	4	3.50

Table 20: Descriptive statistics - staff voice pre-intervention

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
My pupil enjoys writing at school	8	1	8	3.38	2.774
My pupil is a good writer	8	1	4	2.25	1.165
My pupil finds it easy to think of things to write	8	1	3	1.75	0.886
My pupil likes to share their writing with other people	8	0	9	4.63	3.204
My pupil can get frustrated when they are writing	8	0	9	5.00	3.703
My pupil gets nervous when it's time to write	8	1	9	4.63	3.249
My pupil feels confident asking for help during writing time	8	1	4	2.38	1.188
I feel confident in knowing how to develop my pupil's writing skills	8	2	6	3.50	1.309

The average scores (see Table 19), which are all 5.00 or below, show that staff felt that all CWAD found writing difficult pre-intervention, particularly when it came to thinking of what to write. The highest score was for CWAD levels of frustration which, like the CWAD's self-perception, indicated that CWAD did not generally exhibit frustration when writing.

4.4.2 Staff voice post-intervention

Table 21 shows individual responses to the post-intervention questionnaire, along with the average score for each statement. Descriptive statistics can be found in Table 22.

Table 21: Staff responses to the post-intervention questionnaire

	Child A	Child B	Child C	Child D	Child E	Child F	Child G	Child H	Average Score
My pupil enjoys writing at school.	10	10	2	10	9	5	10	10	8.25
My pupil is a good writer.	8	10	1	6	7	4	8	8	6.50
My pupil finds it easy to think of things to write.	8	10	1	10	6	4	5	8	6.50
My pupil likes to share their writing with other people.	10	10	1	10	10	8	10	10	8.63
My pupil can get frustrated when they are writing.	10	10	0	10	7	5	7	9	7.25
My pupil gets nervous when it's time to write.	8	10	0	10	8	5	7	9	7.13
My pupil feels confident asking for help during writing time.	10	10	8	10	10	10	10	10	9.75
I feel confident in knowing how to develop my pupil's writing skills.	10	10	10	10	9	8	9	9	9.38

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
My pupil enjoys writing at school	8	2	10	8.25	3.059
My pupil is a good writer	8	1	10	6.50	2.828
My pupil finds it easy to think of things to write	8	1	10	6.50	3.117
My pupil likes to share their writing with other people	8	1	10	8.63	3.159
My pupil can get frustrated when they are writing	8	0	10	7.25	3.454
My pupil gets nervous when it's time to write	8	0	10	7.13	3.314
My pupil feels confident asking for help during writing time	8	8	10	9.75	0.707
I feel confident in knowing how to develop my pupil's writing skills	8	8	10	9.38	0.744

Scores for all statements on the questionnaire were higher post-intervention. Staff felt more confident in their own abilities to support CWAD with their writing, and reported that pupils were also more confident in asking for help. It is also interesting to note that staff perceived a much bigger difference in CWAD writing confidence and abilities than the CWAD did themselves.

4.4.3 Comparison of staff voice scores

The pre- and post-intervention staff voice scores are compared in the bar graph below (Figure 8) The average score for most of the questionnaire statements increased, showing that staff felt CWAD to be better writers following the intervention. The greatest impact was on confidence, both the staff confidence to support CWAD in developing their writing, and the confidence of CWAD to ask for help when needed. All areas showed an increase in score.

Figure 8: Staff perception of CWAD writing skills
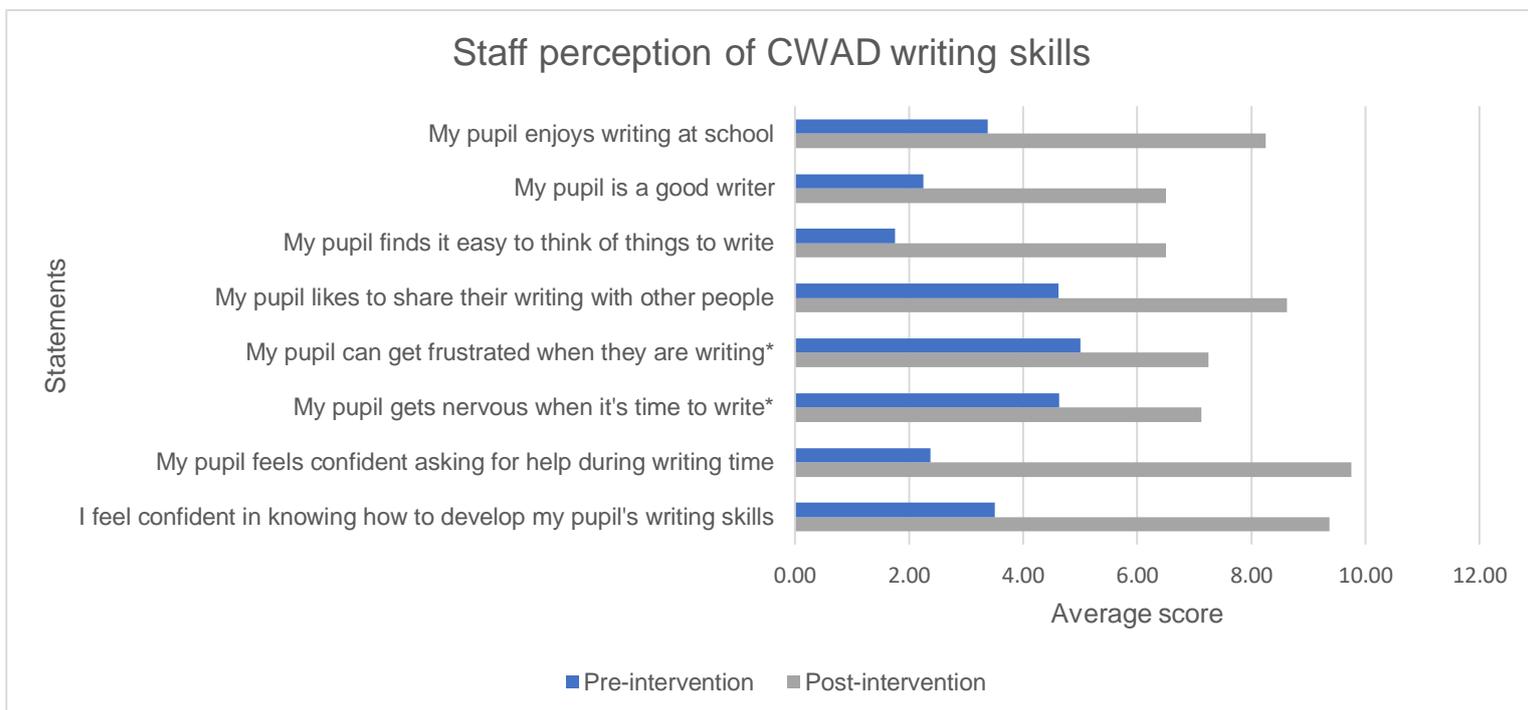
A Wilcoxen Signed-Rank Test showed a statistically significant increase in total staff questionnaire scores, pre- and post-intervention, z=2.380, n=8, p=0.017, with a large effect size of r=0.60 (Cohen, 1988). This means that the null hypothesis can be rejected. The median total test score rose from 29.0 pre-intervention to 69.5 post-intervention.

4.4.4 Staff perceptions of useful writing strategies

Tables 23 and 24 show that post-intervention, staff were more aware of the SHAPE CODING™ System as a tool to support CWAD writing. Supported editing remained a useful strategy cited by adults, although it is possible that the SHAPE CODING™ System could be used as part of this too.

Table 23: Pre-intervention answers to the question 'What strategies do you feel help your pupil with their writing?'

	Number of times the method of support was mentioned
School method of teaching texts	4
School spelling support tool	4
Supported editing	1
Scribing for CWAD	1
Word banks	1
Don't know	1

The total number of responses in Table 23 is greater than the number of pupil participants. This is because some staff cited more than one strategy used to support some pupils.

Table 24: Post-intervention answers to the question 'What strategeis do you feel help your pupil with their writing?'

	Number of times the method of support was mentioned
Shape Coding	3
Supported editing	2
Emotional support	2

The total number of responses in Table 24 is less than the number of pupil participants. This is because the question was not answered on one of the questionnaires.

4.5 Long term impact on writing

CWAD's writing continued to be tracked using the Oxford Analytic Writing Assessment, as per the school's assessment cycle. Results showed that knowledge and skills gained by CWAD through the use of the SHAPE CODING™ System were retained beyond the span of the intervention itself, and even increased due to the continued use of the SHAPE CODING™ in writing lessons. Table 25 shows the scores pre-intervention, post-intervention and then 4 months later at the end of the academic year. Green indicates scores that have improved since the previous assessment, yellow that the score is the same as the previous assessment, and red shows a decrease in score. Descriptive statistics are shown in the boxplot graph (Figure 9).

Table 25: Oxford Analytic Writing Assessment total scores for the academic year 2020-21

	Sep-20	Mar-21	Jul-21
Child A	23	30	51
Child B	29	47	55
Child C	15	28	40
Child D	26	45	56
Child E	15	29	35
Child F	14	26	27
Child G	40*	42	46
Child H	35	45	53

This score is taken from March 2020, as the child was absent for the September assessment. Due to the COVID-19 situation, no formal assessment was completed between March 2020 and September 2020.

Figure 9: Simple Boxplot of Assessment Scores
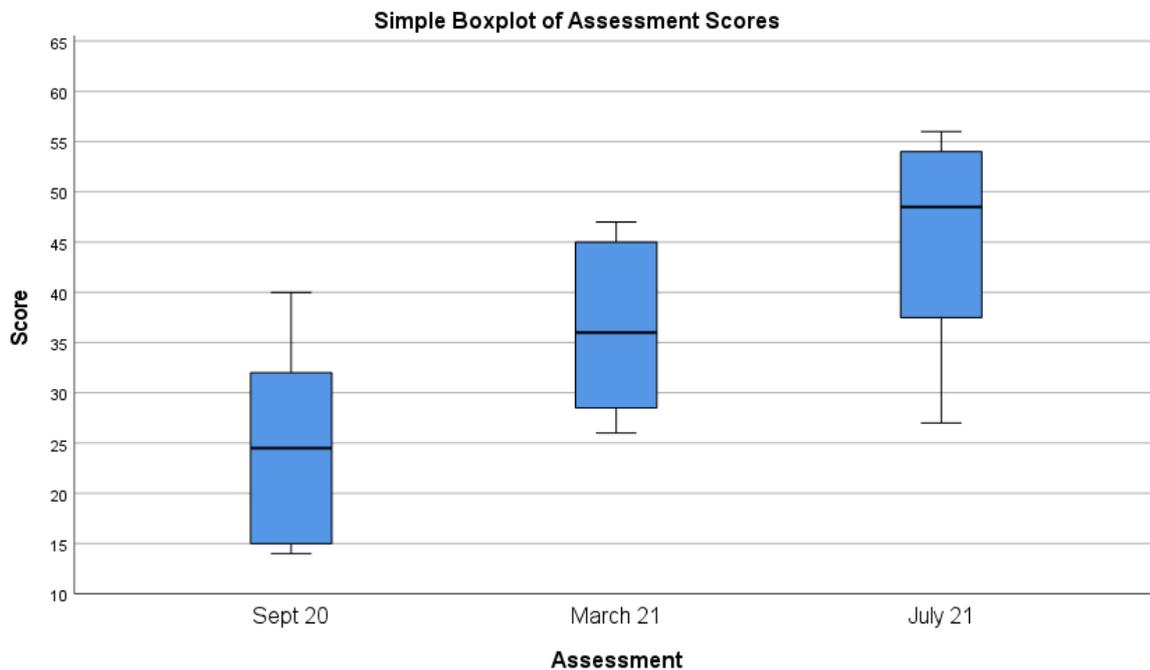
A Wilcoxen Signed-Rank Test showed a statistically significant increase in total scores between March 2021 and July 2021, z=2.524, n=8, p=0.012, with a large effect size of r=0.63 (Cohen, 1988). This means that the null hypothesis can be

rejected. The median total test score rose from 36.0 in March 2021 to 48.5 in July 2021.

This data shows that the SHAPE CODING™ System has a positive and long-lasting impact on CWAD writing and confidence to write. The mean and standard deviations increased with each assessment (see Figure 9). CWAD were able to write more accurate grammatical structures following the intervention and reported that they felt more confidence as a writer. This grammatical knowledge and self-assurance enabled CWAD to produce longer, more accurate pieces of writing with a wider range of narrative elements.

As with all research data, these results have limitations. There will have been other factors contributing to the level of progress made, ranging from natural maturation to the impact of the COVID-19 pandemic on pupil attendance and these will be explored in the discussion chapter. Further research involving a wide range of CWAD would further validate the results of this study.

5 Discussion

The aim of this study was to investigate the effectiveness of the SHAPE CODING™ System in improving the writing skills of CWAD, with the hypotheses that there would be significant improvement in writing assessment scores post-intervention, as well as a rise in CWAD confidence, evidenced by staff and pupil questionnaires.

5.1 CWAD writing ability

Current academic literatures states that many CWAD have difficulties with written grammar, often forming non-standard structures (Kim, 2012; Wolbers et al., 2012; Singleton et al., 2004). This is also true of the 8 participants in this study, who all used non-standard structures in their pre-intervention assessments (see Appendix 4) This research shows that the use of the SHAPE CODING™ System when teaching writing, has a significant impact on CWAD abilities to use correct written grammatical structures and is therefore a useful tool for those working with CWAD. All previous studies have focused on spoken expressive and receptive grammar (Calder et al., 2020; Ebbels et al., 2014), with this study the first to examine the impact on written grammar.

The data from the Oxford Analytic Writing Assessment showed that all children made progress with their writing, with post-intervention scores considerably higher than the pre-intervention scores. Wilcoxen Signed Rank Tests showed that this increase was statistically significant, which given the small sample size, is impressive.

As a multiple case study, there is limited scope to discuss every element of each participant's writing in detail. The main focus will therefore be those elements that showed the most improvement in the post-intervention assessments, namely verb tenses, prepositions and articles. As a group, verb tenses were the weakest grammatical structure on the pre-intervention assessment, followed by prepositions. Some space will also be given to the discussion of narrative skills which were not explicitly taught but were seen to improve alongside the grammatical structures.

5.1.1 CWAD use of verbs

Pre-intervention writing samples showed verbs errors consistent with those found in Wolff's research (2011). CWAD produced phrases such as 'Tom **left** his window open…and the sock **run** away' (Child H), showing inconsistency with tense. Other

verb errors were also evident, such as a lack of verbs, 'boy in home tent' (Child C), missing auxiliary verbs, 'His Dad puting [sic] his suff [sic] away in the car' (Child D), and incorrect noun-verb agreement, 'His dad were drivring [sic]' (Child D). While Wolff (2011) examined writing of CWAD of a similar age range, her participants were all oral and cochlear implant users. The participants of this study used a range of communication methods and audiological equipment and therefore it is not unreasonable to suggest that these verb errors are common across a wide CWAD population.

Current research states that the SHAPE CODING™ System is beneficial for improving the use of verbs and verb tenses (Calder et al., 2020; Kulkarni et al., 2014; Ebbels et al., 2007), and post-intervention assessment for this study confirmed this. While the original studies were of children with Developmental Language Disorder (DLD), rather than CWAD, the results were similar in that participants showed improvement in past tense production and verb argument structure following use of the SHAPE CODING™ System. CWAD demonstrated a wider use of correct tenses and auxiliary verbs, with CWAD able to produce sentences such as 'They were cooking mashmellos [sic] and the furry warn [sic] socks arrived too' (Child H). The use of the -ed suffix to mark the past tense post-intervention, is consistent with that noted by Calder (2020) and Kulkarni (2014), although neither study noted an increased use in auxiliary verbs which was also evident in this research.

5.1.2 CWAD use of prepositions

Another significant area of weakness for the participant CWAD, pre-intervention, was in the use of prepositions. Wolff (2011) found that CWAD make more errors in their use of prepositions than children who are hearing, with the most common error being the omission of prepositions. The pre-intervention assessments for this study correlated with Wolff's conclusions, with CWAD writing phrases with omitted prepositions such as 'his own suitcase to put his imagination van' (Child B) and 'he was car' (Child C). As already discussed, Wolff's participants were all oral cochlear implant users, although this is also true of some of the participants of this study. Widening the demographic of this research to include users of other audiological equipment and communication methods confirmed that the use of prepositions is an area of weakness for a wide range of CWAD.

Existing research around the use of the SHAPE CODING™ System has focused on past tense, wh questions, conjunctions, verb argument, passive and dative structures (Balthazar et al., 2020), with no current studies including the use of prepositions. It is therefore interesting to see the effect that the system can also have on CWAD's use of prepositions. Post-intervention assessments showed a much greater use of prepositions by most CWAD, with only Child F retaining their original score for the element. While the range of prepositions remained limited to 'in', 'on' and 'next to', the frequency and accuracy of usage improved. Examples of correct usage include, 'there was his dad next to his glittery van' (Child B) and 'put the socks in the bag' (Child C). It would be beneficial to have further research on this area, to add to the findings of this study.

5.1.3 CWAD use of articles

Pre-intervention assessments showed that CWAD omitted articles from their sentences, with phrases such as 'look like sun' (Child E) and 'dadd [sic] got bluoo [sic] chert [sic]' (Child A). This echoes van Beijsterveldt & van Hell's research (2010), which had a similar demographic of CWAD with a range of communication modes, although their participants were slightly older (11-12 years old) and the study included additional groups of adolescents (15-16 years old) and adults. The study was also conducted in the Netherlands, but retains its usefulness in this research as the Dutch language uses articles before nouns in the same way as English. It is therefore clear that a large section of the CWAD population, and indeed the population of adults who are deaf, find the inclusion and correct use of articles to be challenging when writing.

Despite this known difficulty, there are no studies within the current body of research around the SHAPE CODING™ that takes the use of articles as a focus; although articles have an assigned colour, this was a later addition to the system (Ebbels, 2007). This study, however, found that CWAD use of articles increased following the SHAPE CODING™ System intervention. Post-intervention assessments showed progress with the use of articles, with all children scoring for this element, including Child E and Child F. Child F began 4 out of 5 sentences in his first section with the article 'The', showing that he understood its use at the start of sentences. While this is not a developmental pattern seen in hearing children, Bybee (2010) noted that

children are able to create analogies – using new language in patterns based on taught examples. In the first section of his post-intervention assessment, Child F was able to apply the pattern of article-noun-auxiliary verb in his written sentences, following the structures taught during the intervention. The effect of the SHAPE CODING™ System on the use of articles is a further area that would benefit from more research.

5.1.4 Narrative skills

While the SHAPE CODING™ System is a grammar intervention, its use in writing lessons also had an impact on CWAD narrative skills. There is research to suggest that CWAD have delayed or disordered narrative skills, showing a lack of coherence and cohesion (Arfe & Boscolo, 2006; Koutsoubou et al., 2006). Although these studies are around the writing skills of older students in Italy and Greece, it is not unreasonable to suggest that younger CWAD, with less time in formal education, would also exhibit these difficulties. There is currently no published research around the impact of the SHAPE CODING™ System on narratives, however this study found that its use improved the narrative skills of CWAD, with total scores increasing post-intervention (see Table 7).

Having the knowledge of grammatical structures gave CWAD the ability to write longer pieces and therefore include a greater number of narrative elements. Initially, Child C wrote 27 words (approx. 6 sentences). These were very simple and just described the prompt picture, such as 'boy in home tent' (see Appendix 4). Post-intervention, Child C wrote 114 words (approx. 15 sentences). They were able to convey more information such as character identify and emotions such as 'dad is excited to go camping we are gonna to get ready going at the camping dad have to wait for boy'. Through the development of written grammar, CWAD were able to formulate more complex sentences and therefore a more interesting narrative.

5.2 Pupil Voice

Pupil Voice is not an area that has been previously examined in relation to the use of the SHAPE CODING™ System and it was therefore interesting to look at the effect of the intervention on pupil confidence. While results did not reach statistical

significance, participant CWAD did become more confident in writing after having taken part in the intervention (see Figure 7). It must be remembered that the sample was very small, and therefore it is difficult to reach statistical significance. There were also decreases in some scores, however, for the statements 'It's easy to think of things to write' and 'I can get frustrated when writing' (see Figure 7). This does not mean that there was a decrease in the level of frustration, rather a decrease in score which showed that children were more frustrated than previously. This could be because the intervention's focus on grammatical accuracy meant that the CWAD's cognitive load was maximised, as per Sweller's theory (1988), and they therefore found it more difficult to think of ideas to write about.

There were several limitations to the pupil questionnaires, including that some CWAD were poor reporters of their own abilities. Most CWAD answered the questionnaires using the full range of responses but Child A, Child C and Child H only selected numbers 0, 5 and 10 on the scale. These were the points marked with symbols (a sad face at point 0, a straight face at point 5 and a smiley face at point 10). It therefore seems that the three CWAD were aligning their views with the visual symbols, rather than using the full Likert scale. It might be useful either for future questionnaires to have images at each point, although this may be difficult, or for CWAD to have training on using Likert scales before attempting the questionnaire.

A further aspect of the questionnaire was the open-ended question 'What helps you when you are writing?' Post-intervention, 6 CWAD mentioned the SHAPE CODING™ System as a strategy for supporting writing that they were familiar with, compared to only one child pre-intervention. 5 mentioned it in a positive way; one participant stated that they disliked using the system as it was hard. The SHAPE CODING™ System gave CWAD a specific strategy that they knew would help them, thereby developing their metacognition, which Marschark & Knoors (2012) identified as being very poor in CWAD. Having an awareness of where they are successful or where they need to improve in their learning is an important skill if CWAD are to make the progress they are capable of making.

5.3 Staff Voice

As with pupil voice, staff voice has never before been analysed in relation to the use of the SHAPE CODING™ System. There is no current research to compare this data to. It is therefore interesting to note that the staff voice questionnaire did yield statistically significant results, and showed that staff felt that CWAD confidence increased following the intervention (see Figure 8). While it could be argued that staff can be more compliant to the researcher's views and give answers that they feel would 'help' the study, in fact the post-intervention questionnaire was distributed 6 months after the pre-intervention questionnaire and staff had no access to their original answers.

The greatest improvement in scores was for the statement 'My pupil feels confident asking for help during writing' and 'I feel confident in knowing how to develop my pupil's writing skills' (see Figure 8). Staff felt that the SHAPE CODING™ System better equipped them to support CWAD in writing lessons, and is therefore a useful tool in the classroom. This is echoed in the responses to the open-ended question 'What strategies do you feel help your pupil with their writing?' The SHAPE CODING™ System was not mentioned on pre-intervention questionnaires, showing that staff were unaware of it as a tool, but post-intervention it was cited as a useful strategy for three participant CWAD. As the first study around the use of the SHAPE CODING™ System that has explored staff and pupil voice, this is an area that would benefit from further research.

For future practice, it would be beneficial for all staff working with CWAD to complete training courses, rather than rely on disseminated information from ToDs, as interventions have better results when those delivering it are an expert in the technique or programme used (Strassman & Schirmer, 2015). This is, of course, dependent on availability and funding which are important considerations to take into account. All staff, however, clearly felt that the SHAPE CODING™ System was a useful strategy and benefitted the CWAD that they worked with.

5.4 Limitations

As with any piece of action research, there are limitations to this study. While the data shows that CWAD made statistically significant progress between the pre- and post-intervention assessments, it cannot be proved beyond all doubt that the cause of the progress was the use of the SHAPE CODING™ System. It was not possible to include a control group for this study and therefore the impact of other factors that contributed to this progress, including natural maturation, speech and language therapy, and other learning both in school and at home, cannot be ruled out. The sample size was small and only included CWAD with severe to profound hearing loss. Therefore it can only be concluded that the SHAPE CODING™ System is beneficial for those CWAD who have a similar profile or demographic to those participants in this study. Success will also depend on the knowledge and skills of staff delivering the intervention. Unlike the participants in this study, not all CWAD have delayed or disordered language and the system therefore may not be of use to everyone.

However, there are also limitations to the study which point to the effectiveness of the SHAPE CODING™ System. The COVID-19 pandemic had a significant impact on pupil attendance. Good attendance at the school where the study took place is considered to be 95% - only three of the participant CWAD had good attendance for the period of the intervention. The remaining 5 participants had attendance ranging from 94.17% - 67.43%. There was also a period of staff absence, but this was during a period of isolation for the whole group. Despite these difficulties, statistically significant progress was still made, showing the strength of the intervention and of the SHAPE CODING™ System.

5.5 Implications for future practice

There is already academic research to show that the SHAPE CODING™ System is an effective tool for supporting children with language disorder (Calder et al., 2020; Ebbels, 2014) but until now there has been no work investigating its use with CWAD. This research shows a significant increase in the ability of CWAD to use grammatically correct structures when writing following the use of the system in

writing lessons, and further research would be beneficial to confirm its efficacy with the wider population of CWAD. Significant progress was made over a short intervention period and it therefore seems logical to suggest that the regular, long term, use of the system during lessons would continue to have even greater impact on CWAD written grammar. The SHAPE CODING™ System is an excellent tool through which grammar can be explicitly taught, and using it alongside a topic or reading book, as was done in this study, will help to build narrative skills alongside sentence structure. The SHAPE CODING™ System should therefore be considered an integral part of the ToDs toolkit of interventions.

5.6 Future Research

Further research into the use of the SHAPE CODING™ System is essential if the findings of this study are to be generalized across the CWAD population. Data collection could include CWAD with a wider range of audiological profiles, CWAD educated in different settings, or cohorts of different ages. As this is the only study that looks at the impact of the SHAPE CODING™ System on pupil confidence, it would be useful to complete further research in this area to confirm these findings. Studies could also be done into the impact of the SHAPE CODING™ System on CWAD grammar results of the Standard Assessment Tests (SATs) taken at the end of primary education, comparing those who had received tuition using the SHAPE CODING™ System to those who had not. A longitudinal study would also provide useful information on the impact of the use of the SHAPE CODING™ System over time.

6. Conclusion

This research project investigated how the use of the SHAPE CODING™ System in writing lessons affected the writing skills of CWAD. The difficulties that CWAD can have with writing are well documented (Williams & Mayer, 2015; Kim, 2012; Wolbers et al., 2012; Wolff, 2011; van Beijsterveldt & van Hell, 2010; Singleton et al., 2004), and yet there is a lack of research around effective interventions to support in developing these areas of weakness. Strassman and Schirmer's review of the research around effective writing instruction (2013) found only 16 studies over the 25 years prior to the publication of their paper. Action research is therefore vital to add to the small body of knowledge that currently exists.

The findings of this research revealed that use of the SHAPE CODING™ System does have a positive effect on CWAD writing, with a wider variety of grammatical structures used by CWAD in independent assessments post-intervention. Not only was there an impact on written language, but writing confidence also improved, with both staff and pupils recognising that the SHAPE CODING™ System is a useful tool. Further research would be useful to confirm this effectiveness across the heterogenous population of CWAD.

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Appendices

<u>Appendix 1: Ethical Approval Documents</u>

University of Hertfordshire UH

SOCIAL SCIENCES, ARTS AND HUMANITIES ECDA

ETHICS APPROVAL NOTIFICATION

TO	**Alice Bailey**
CC	**Lorna Gravenstede & Joy Rosenberg**
FROM	**Dr Ian Willcock, Social Sciences, Arts and Humanities ECDA Chairman**
DATE	**17/11/2021**

Protocol number: EDU/PGT/CP/05296

Title of study: An evaluation of the effectiveness of the SHAPE CODING™ System in improving the writing skills of children who are Deaf

Your application for ethics approval has been accepted and approved with the following conditions by the ECDA for your School and includes work undertaken for this study by the named additional workers below:

no additional workers named

General conditions of approval:

Ethics approval has been granted subject to the standard conditions below:

<u>Permissions</u>: Any necessary permissions for the use of premises/location and accessing participants for your study must be obtained in writing prior to any data collection commencing. Failure to obtain adequate permissions may be considered a breach of this protocol.

<u>External communications</u>: Ensure you quote the UH protocol number and the name of the approving Committee on all paperwork, including recruitment advertisements/online requests, for this study.

<u>Invasive procedures</u>: If your research involves invasive procedures you are required to complete and submit an EC7 Protocol Monitoring Form, and copies of your completed consent paperwork to this ECDA once your study is complete.

<u>Submission</u>: Students must include this Approval Notification with their submission.

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Validity:

This approval is valid:

From: 17/11/2021

To: 31/12/2021

Please note:

Failure to comply with the conditions of approval will be considered a breach of protocol and may result in disciplinary action which could include academic penalties.
Additional documentation requested as a condition of this approval protocol may be submitted via your supervisor to the Ethics Clerks as it becomes available. All documentation relating to this study, including the information/documents noted in the conditions above, must be available for your supervisor at the time of submitting your work so that they are able to confirm that you have complied with this protocol.

Should you amend any aspect of your research or wish to apply for an extension to your study you will need your supervisor's approval (if you are a student) and must complete and submit form EC2.
Approval applies specifically to the research study/methodology and timings as detailed in your Form EC1A. In cases where the amendments to the original study are deemed to be substantial, a new Form EC1A may need to be completed prior to the study being undertaken.

Failure to report adverse circumstance/s may be considered misconduct.
Should adverse circumstances arise during this study such as physical reaction/harm, mental/emotional harm, intrusion of privacy or breach of confidentiality this must be reported to the approving Committee immediately.

Pupil Writing Survey

1. I enjoy writing at school.

0	1	2	3	4	5	6	7	8	9	10

2. I enjoy writing at home.

0	1	2	3	4	5	6	7	8	9	10

3. I think I'm a good writer.

0	1	2	3	4	5	6	7	8	9	10

4. It's easy to think of things to write.

0	1	2	3	4	5	6	7	8	9	10

5. I like to read my writing to other people.

0	1	2	3	4	5	6	7	8	9	10

6. I can get frustrated when I'm writing.

0	1	2	3	4	5	6	7	8	9	10

7. I get nervous when it's time to write.

0	1	2	3	4	5	6	7	8	9	10

8. I feel confident asking for help during writing time.

0	1	2	3	4	5	6	7	8	9	10

What helps you when you are writing? _____

Staff Writing Survey

1. My pupil enjoys writing at school.

0	1	2	3	4	5	6	7	8	9	10

2. My pupil is a good writer.

0	1	2	3	4	5	6	7	8	9	10

3. My pupil finds it easy to think of things to write.

0	1	2	3	4	5	6	7	8	9	10

4. My pupil likes to share their writing with other people.

0	1	2	3	4	5	6	7	8	9	10

5. My pupil can get frustrated when they are writing.

0	1	2	3	4	5	6	7	8	9	10

6. My pupil gets nervous when it's time to write.

0	1	2	3	4	5	6	7	8	9	10

7. My pupil feels confident asking for help during writing time.

0	1	2	3	4	5	6	7	8	9	10

8. I feel confident in knowing how to develop my pupil's writing skills.

0	1	2	3	4	5	6	7	8	9	10

What strategies do you feel help your pupil with their writing? _____

Analytic Assessment of Deaf Children's Writing — Score Sheet

A. Does the child.... 1. Include spaces in alphabetical letters to resemble words?

No evidence	Beginning to	Sometimes	Mostly	Systematically and correctly
(rakfleosanchF evkdmsormbir)	(Evident once e.g. wmsm amsdmri)	(Evident 2 or 3 times)	(Evidence present under most pictures)	(All writing resembles words)

1. Put words in subject-verb word order, e.g. 'mum put'/'boy go'?

0. No evidence	1. Beginning to	2. Sometimes	3. Mostly	4. Systematically and correctly
	(Evident once)	(Evident 2 or 3 times)	(Evidence present under most pictures)	(appropriate subject-verb order)

2. Form noun and verb phrases, e.g. 'clothes in car'/ 'going holiday'?

0. No evidence	1. Beginning to	2. Sometimes	3. Often	4. Systematically
(Uses isolated words not forming noun or verb phrases)	(Evident once)	(Evident 2 or 3 times)	(At least ¾ of text shows some connection)	May have 1 or 2 isolated words (appropriate noun-verb phrases)

3. Include appropriate prepositions, e.g. 'in'/ 'to'/ 'at' ?

0. No evidence	1. Beginning to	2. Sometimes	3. Often	4. Systematically
	(e.g. in bag)	(e.g. in bag/ in car/on sand)	(include a variety of prepositions)	A few errors allowed (appropriate variety of prepositions)

4. Use the articles 'the' and 'a' appropriately?

0. No evidence	1. Beginning to	2. Sometimes	3. Often	4. Systematically
	(Evident once)	(Evident 2 or 3 times, not always appropriately)	(often, and mostly appropriately)	But a few errors allowed (appropriate use, few omissions)

5. Use connectives such as 'and', 'then'/ 'next'/ 'so'/ 'after'/ 'now'/ 'because'?

0. No evidence	1. Beginning to (Evident once)	2. Sometimes (Evident 2 or 3 times)	3. Mostly (include a variety of connectives)	4. Systematically and correctly (appropriate variety of connectives)

6. Use full-stops and capital letters correctly?

0. No evidence	1. Beginning to	2. Sometimes	3. Often when required	4. Systematically But a few errors allowed (e.g. Names and starting sentences)

7. Use verb tenses, e.g. 'go'/ 'went'/ 'saw'/ 'opened'/ 'was packing'?

0. No evidence	1. Beginning to (evidence of verbs — 1 or 2 isolated changes in tense)	2. Sometimes (more than 2 changes in tense)	3. Often when required (a variety of tenses — some correctly)	4. Systematically But a few errors allowed (appropriate use of a variety of tenses)

8. Use punctuation (' " , ! ?) beyond full-stops?

0. No evidence	1. Beginning to	2. Sometimes	3. Often when required.	4. Systematically But a few errors allowed

9. Include substitutions or omissions (not including articles), e.g. 'they are so happy to the beach'/ 'he went down and next to the door'?

0. Constantly (this includes single word writing)	1. Often (most sentences are missing words)	2. Sometimes (at most half the time)	3. Rarely (at most a quarter of the time)	4. No evidence

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10. Include unnecessary words and/or morphemes, e.g. 'is everything is locked'/ 'painted'?

0. Constantly	1. Mostly	2. Sometimes	3. Rarely	4. No evidence

11. Use words relevant to the illustrations?

0. No evidence	1. Beginning to	2. Sometimes	3. Mostly	4. Systematically and correctly
(dnejiri)	('man')	(man bag car)	(man bag boy door boot)	(Many appropriate words)

12. Include appropriate pronouns, e.g. 'he'/ 'she'/ 'they'/ 'his'/ 'hers'/ 'it'/ 'their'?

0. No evidence	1. Beginning to	2. Sometimes	3. Often	4. Systematically but a few errors allowed
	(using e.g. 'he' throughout)	(using 2 or 3 different pronouns)	(including a variety of pronouns)	(appropriate variety of pronouns)

13. Include information beyond what is depicted, e.g. names (people and/or items), places, time?

0. No evidence	1. Beginning to	2. Sometimes Include 2 or 3 examples	3. Mostly Include many examples	4. Systematically Include sufficient information to create a story
	('Sam' or 'Dad')			

14. Include information on characters, feelings, intent, humour ?

0. No evidence	1. Beginning to	2. Sometimes	3. Often	4.Includes sufficient information to create a story

15. Include colloquial language/ expressions e.g. 'far away'/ 'nearly there'/ 'stuff'/ 'thing'?

0. No evidence	1. Beginning to	2. Sometimes	3. Often	4. Systematically and Appropriately
	(1 or 2 examples)	(3 or 4 examples)		

16. Include direct speech?				
0. No evidence	1. Beginning to (1 or 2 examples)	2. Sometimes (3 or 4 examples)	3. Often	4. Systematically and appropriately

Appendix 4.1: Pre-intervention writing assessment - Child A

	dadd got bluue chert dadd got bag on the soc he namme george he feel happy cowoler fo crowses orinch tempill I sorw Sunny.
	is his friend heyor a bay and he got a cowoer fo cary orindnd yelow cary he got a window
	he tring abowt cowoen and the soc opn the soc anden Riowiny
	ther moring ther siyer thay dowiny a marshlow I sorw a berd.

	it is a lovely sunny day once there was a boy and his name was goerge and he got his suitcase to put his clothes ine
	And his friend called Charlie his own Suitcase to put his imagination van.
	He drived in the van put his suitcase in the van ready for camping they both talked at each other Suitcase opened and all the sox came out the van
	they went in the shade and filled the tent up reall to eat the marshamallow from the campfire.

	boy in home tent
	The he is in the car and the boy was here
	He was car they are here
	Food is good boy is happy

	Once a pone a time there was a tiny little cat george he was packing for caping.
	His Dad puting his suff away in the car.
	When his dad were driving the rock bely allow.
	when it nightume yeth were haveing marshnallow.

Opnt Once upon a time is go I'm happy I Name Junt I'm and but go camp. (bthe) camp. SeoKand put Bag Go Van Cadting Look like suh!

Semll Ahh nice going Camp! Van green star Van Bigger. Dad name Teter hair. yellow Good in like happy beacoses CAMP!

oh-no! Scok! onep Van Gone Scok! I'm ready Tap Mrs Mrs yes (Good Lock)! The is are I'm HAPPY! becseuse Camp. I Hey, Look there Camp.

the is are Camp Fire Marshmallow stee See Mmmmm! Idea Camp Bed yamy! I treat Good and The end.

	Boy and lightening t-shirt not clothes. boy and trousers trouser. boy and sock an suitcase yes. boy and cupbourd different Colour and red has purple.
	Dad go car Windows and wheels for is black Yellow, rug up Windows.
	windows go tent and road yes. Dad ok blow away. Windows
	Yes tent said boy very good ok yes Dad eat Stars Look up like camp has fire and marshmallows!

	The littlebthy to gicker he close and Bad and boy said I'm comeing Daddy boy said how very long early elird little best I can see It was tens wow It not Fard away I Flee feel exsitxed
	The Dad put on the car at the hoildday bay Dad very angry because the little boy Not comeing I very bore bored the little boy said I'm here ho oh well done are ready let go
	The little boy talked the Dad. The Dad said stop take talkking because I try to piding the car and the Dad and little boy didt didnt k'one know that he droped stuff the stuff
	The Dad get the stuff and little boy said well done Dad Dad said Ittime Food okay Dad now Dad said Ittime Sleep troom tommorrow we go home and your mum will here yey

	Tom is happy because he is packing his clothes because he'll s'going in the trip with his frind and he will think about how they go on his trips because the is coming because he don't know yet what will happen nxt to
	Tothen Tom's frind putting his bag in the van and he put the window open and he still dones't konw yet what will happen next
	Tom he left his window open and then his bag open and the sock run away and then he drove back to find he sock and back in van and then they was talk about why he left the window open
	Tom frind found his sock and put it back and they was eat som food are they happy because he find to his sock.

Appendix 5: Samples of CWAD writing during the intervention period.

Categorising words and using them to form sentences.

Using shapes and colours to help form subject-verb-preposition sentences.

Using previously taught structures to write a descriptive paragraph.

Using shapes and colours to help form subject-verb-adjective sentences.

Longer writing piece using taught sentence structures. CWAD edited their work by identifying all the nouns (red words) and adding adjectives (green words).

	he going to put a socks and thousers and a teaShirt in the bag! and he looked at the camping lasted what the mether they were exited to go campling
	whan It get a glitter on the van and the dad put a bag they gonn to put in the van! I am reading
	thee and then the socks had blow away! and they both talking about we can't do for marshmallow on top the flyer!
	"and then they are reading for the marshmollow" but there are 2 left of the socks. but we on campling!.

Once there was a boy and his name was George but when he was gonna go to camping he got his cloths in his elder array case ready to go he looked at the window to see how beautifully the weather is.

When he got out there was his dad next to his glittery van he's got georges case to go in his dad's van he went to his van and waited about 6hours and he was asleep and when hegot up he said I feel it's like 5 minutes and he yawned.

And then he was in his dad's van oh no! the socks had blown away but they didn't see it blown away what thife are talking about? is 1 build a tent 2 get the bags 3 burn the campfire. ✗

And they build everything what they had done talked about in the van yes! they got the socks back and they enjoyed going too the the camping.

	The bby yili excited to get ready to went camping put the socks in the bags
	dad is exited to go camping We are ganna to get ready going at the camping dad have to wait for boy
	The socks is running away they talk about camping they saw the socks they got go to find the socks we have go back to get the socks and they got the socks and now we going go back camping
	Where of the camping we hungry they are enjoying to eat a marshmallow yum We got the ten and a forest and have good We got the fire to got woods to turn into the fire

	Once there was a boy called Dash and he was packing his socks. His shirt was red and yellow and his shorts were green. He was going to camping he looked outside the window he wondered what the weather was.
	Dash's dad got his suitcase and he was putting it in the messy van and he shouted "Come on we got too go or we will be late."
	Dash's dad was driving and they were talking while the sell of the van! And the socks blew off.
	And they set up the tent and got marshmallow on the fire in the forest. Dash shouted "yay dad I like this."

	THi Schooh! I name jack the I excited because go is Camp! I very excited the bag my put is Sock, Shts and my daddy I waiting Van.
	Th Hi School, tha go camping! Becuue the got 2 weeking! The my Son with me in on Van green,pink and yellow it's is nice? The Daddy and Son with go Van go Camping
	ignore The Daddy gont is Son bearies Danger Van. oh ho! Daddy,Daddy! Has Sock gone! (groan) What!? I'm trying Van Sajid Dad. But,But,but and but Said Son. But no! say Dad.
	Phew, got Sock Say Son. Ok Son, you give mashmallows in Camping! Said Daddy yeah but a lot troe I'm scread Said Son. It okay Said Daddy, Goodbye School! The End! (Said Both Son and Daddy)
When asked to use the SHAPE CODING™ System shapes to rewrite a section of the narrative:	Jase are happy because the holiday in camping. Jase and Dejar are excited because is sat in camp. Jaso and Dejar are funny becucas he story in Camp. Jaso and Dejar are scary becuees he horror in camp. He crying because he dream horror in camp. Jaso and Dejar are calm becueose he sleeping in Camp. Jaso and Dejar are love becuease he warm in camp. Jaso and Dejar are Sad becuease he TV Sad in camp.

	The Jard has sandwicher. The Jard is suitcase and sockers. The Jard is suitcase and clothes. Her oar Her oar late Her her. The Jard has cupboard.
	The Daddy has var in the on rug. Daddy is in the whels. Daddy is windows green and stars. The var has Daddy in suitcase.
	The Daddy is not ignor var not talk. Jared has where going yes said Daddy allowed. Went going in was you allowed tent. "Daddy has road the Var." Jared is waiting I why far in road. Daddy is var back I not cry can't look and blow away).
	At last has happy with you and Daddy has Jard. What is make fine has you will can marshmallows yes Daddy can your eat. You I know allowed look camping.

The Jame is packeting on his cother.
They jame were Felt excited.
He is ready to go holiday.
Dad called Jame said Im comeing.
I can see a sock and short bath. (bath towel)
I saw window. I saw tens. (tents) green
I can colour Red, bule, orange, pink, yellow.
Jame is going donnstari.

The Dad is put bag on the vans
The Dad were Felt calm.
I can see a huge vans.
There are colour green, red, brown, red, bule, orange, & black grey, yell
I saw a reds door and I can see a wheel.
On the van I can see a flower and star.
Vans there are light.
Dad will drive not Jame because he is children.

Dad and Jame is driveing. dropped (soaker)
We have a prombel he drop a sock Ops.
Both are singing a beaitful song.
Dad and Jame is talking about eating the Marshamol.
I think he driveing so fast?
Dad askd to Jame there are abdst there.
I can see a grass a yellow grass with the green.
I can see a red and orange Flower.

	Dad and Jame is up to treetens. (tents) he doing a warm Fire. Dad and Jame is holding a stick with marshmalla. there are huge tens colour is rainbrown. I can see a bird with beaitfull white and yellow. Dad pick up sock on the river. James said "What a beaitful bird and trees (') Dad said to Jame bed time. ends
When asked to use the SHAPE CODING™ System shapes to rewrite a section of the narrative:	Dad James is driveing in the van. Dad James was droping his socke. Dad James were talking. Dad James there is singing a beaitful song. Dad James is driveing so Fast. Dad James is driveing so slow. Dad James is feeling so tired.

	The exctied boy is Packing in his warm room because he is going on a stargazeing with his ~~wonderful~~ wonderful friend. later night "I am so exctied" The boy is going outside and wait for his friend to Pick him up.
	The boy's friend arrived to his house with his big green van and helped him to Put his bag in his van. The boy and his friend are so excited to go on a Stargozeing. The boy and his friend got in the van and ready to go.
	The boy and his friend are driving to the stargazeing. The boys are talking to each other and they didn't kown that the warm socks are Flying away. They are igbring the warm Socks. Then they arrived to the stargozeing.
	Finally the boys arrived to the Stargazeing. They were cooking Mashmellos and the funny warm Sock arrived too. "The boys felt ~~too~~ Soo exctied". This was the wondful night stargozeing. I can't belive it this was the wonderful night stargozing the end.