

TITLE

Examining the impact of dyslexia in the Voice Studio: Strategies and considerations for teaching song to Children aged 7-11, with Dyslexia.

INTRODUCTION

According to the British Dyslexic association, 10% of the population are dyslexic (British Dyslexic Association, 2024), while the International Dyslexic Association, cites that it could be almost as high as 15%. Having anecdotal evidence from my own voice studio, alongside my own experiences as a dyslexic person; I have seen the impact a change in teaching strategy can have on the neurodiverse student, unlocking potential previously held back by the traditional voice teaching strategies for singing. With such a significant percentage of the population affected with this neurodiversity, I believe further research into developing strategies to teach song from score to this group; would have a significant impact on a reflective percentage of the population of our voice students.

Many existing teaching strategies I use to teach singing in my vocal studio have been adapted to suit my own neurodiversity and to suit those of some of my students. Over the past four years of teaching I have been combining other Educational strategies (not prescriptive to voice) with existing traditional singing pedagogy techniques. My teaching strategy in voice has been to suit the learning challenges shown by the individual which have often derived from their neurodiversity. This is what I want to explore, and evidence further with this research. I am keen to develop strategies to treat the symptom rather than a diagnosis of dyslexia, so that its use can be taken to the wider neurodiverse community or those who's learning pathways favor the routes I will hopefully uncover with this research.

DYSLEXIA

Dyslexia is a categorized as a learning difficulty that can impact many parts of person's learning pathways. Its effects can disrupt a person's skills with word reading, speech fluency and spelling. However, the difficulties have a much wider impact than the person's ability to meet educational language markers in school or read large passages of text with ease. The difficulties can extend to issues expanded upon in **Appendix A**. It should be understood that symptoms vary and manifest very differently from person to person, and like most other neurodiversity's there can be a sliding scale of how much a person can be affected (Duane, 2001; Reid, 2016).

Dyslexia disrupts auditory processing. In particular a skill known as Phonological Processing (Reid, 2016). Phonological processing is the route in which humans utilize words to convey thoughts and emotions, and how these communications are comprehended and interpreted.

According to many scholars a phonological deficit is a key identifier when diagnosing dyslexia. (Tallal & Gaab, 2006; Duane, 2001). The “Phonological Representation Hypothesis” has been long held as the basis of most research and development of teaching strategies as recommended by Hatching, Snowling (2002, p.69-70) in their review of the hypothesis as a basis for teaching theories. However, papers such as Stein (2023) have made the case that using the phonological theory is not thorough basis for diagnosis as it does not give detail to the cause, merely a possible indicator. Phonological difficulties is a symptom of other neuro deficits such as acquired brain injury. The paper made very short summaries to opposing theories, and was not thoroughly cited which gave less weight to its arguments for a current change in the widely used hypothesis. Despite their disagreement with the hypothesis being a diagnosis tool, it was agreed that the deficit is a symptom; and therefore using it as a route source for teaching strategy will create approaches relevant to the person. Therefore given its prevalence in current educational teachings, and my ambition to align with what is being taught in the classroom I will lean on this theory to guide further reading. As this paper is about building on existing theories and beyond my remit to understand the anatomy of diagnosis being developed by medical and educational psychology scholars.

Further to this; to be noted that other difficulties may be observed with people with this disability, however they are not used as diagnostic markers. (Rose, 2009; Peer, Reid, 2016). These are detailed in **Appendix A**. These symptoms can vary in prevalence from person to person, and are for the most part are not things that can be empirically measured. Therefore given the phonological processing is a measured learning outcome, it will be where I focus my further reading.

The Phonological Process and the Brain

Phonological processing requires three key stages. Phonological awareness, phonological memory, and rapid naming. Phonological Awareness is how a human differentiates between sounds and has the ability to manipulate sound. Phonological memory is the ability to remember and recall those learnt sounds and finally, Rapid naming is the ability to relate those sounds to visual stimuli, such as letters, numbers and shapes. All three processes occur in the left hemisphere of the brain and are the basis for language development and learning. There are

five main areas of the brain which work together in a network to support phonological processing in the brain (Rueschemeyer & Gaskell, 2018; Pattamadilok, 2017). **Appendix B** has an outline of these areas along with a visual diagram.

Phonological Processing and Dyslexia

Diagnosis

In the UK, there is not one standard test used for diagnosing dyslexia. Diagnosis typically involves a comprehensive assessment by a qualified professional, such as an educational psychologist or specialist teacher, who uses a combination of standardised tests, interviews, observations, and background information to assess an individual's reading and language skills. (Reid, 2016; World Health Organisation, 2012)

Any testing used in the UK, must be approved for us by the Specific Learning Difficulties Assessment Standards Committee, which is a governing body who make recommendations to the UK's Department of Education for testing standards across Special Education Needs. Despite the range of testing available, they all center on identifying phonological processing difficulties.

Although diagnostic markers for dyslexia processes exist, there is debate about the specific brain regions involved. Richlan (2012) critiques the traditional model focusing on the left temporo-parietal regions for lacking empirical support, instead suggesting a malfunction within a left hemisphere network involving the occipito-temporal, inferior frontal, and inferior parietal regions. This is based on a review of imaging studies, though it didn't conduct original research.

Supporting this, Cao et al. (2006) found that dyslexic children have deficits in orthographic representation in the ventral temporal cortex and mapping deficits in the inferior parietal cortex. Another imaging study by Kovelman et al. (2012) showed that typical phonological processing activates the left dorsolateral prefrontal cortex, whereas dyslexic children show less activation. These findings support the theory of a network deficit rather than a pinpointed area.

Although the study is dated back to 2006, and an advancement in imaging techniques over the first decade of the 2000's, saw greater influx in medical imaging research within this area, which evident from the number of studies drawn from this era in the Richlan et al (2012) review and

my own searches. The influx at the time of dyslexia-based research was also influenced by the 2002, US No Child Left Behind Act. Owing to this much more research could be funded to explore the cause of reading difficulties in children. (Rhodes, 2012) as US policy was striving for stringent assessment criteria within education (Dee & Jacob, 2011)

The additional funding to research also opened up the use of medical imaging. However, despite its advancement in the last 11 years. There has been a decrease in the breadth of research to draw upon from more recently . The reasoning behind this decline was alluded to by Miles (2006, P.70) in their Book on the History of Research in Dyslexia. Which discussed the question whether dyslexia remained a medical or educational matter. If the research sat within the educational field, they would be exploring a person's educational deficits as appose to the physiological understandings. Therefore it could be an insight in to the decline in medical imaging based studies to draw from.

If further research could be drawn upon by repeating the studies used here to solidify its findings with the advancement in imaging techniques, it could improve our understanding at anatomical level and possibly gain further insights to the processes within the brain.

Whilst having a degree in medical science, I realise my limitations within neurological science. Therefore; for the purpose of this project I need to take a broader view of defining dyslexic deficit at an anatomical level and trust the conclusions drawn in peer reviewed articles as the basis of my anatomical understanding. Whilst the specific affected pathways in the brain are yet to be established through further medical imaging research, it can be evidenced that phonological process pathways are disrupted within the dyslexic brain within the left hemisphere within the regions that are key to phonological processing. This conclusion has been drawn from the breadth of studies available and that of studies with objective, data driven evidence from medical imaging, which is supportive of the narrative theory.

The lack of agreed research to pinpoint anatomically the areas of deficit in dyslexia could present a weakness in this research when looking at further relationships between phonological processing and that of the processes required to learn music within the vocal studio setting, as it could be concluded that the close relationships discussed later in this study, may not be clear at anatomical level, and therefore could be reliant on less empirical evidence.

A further area of research that has stood out within my reading; has been the possible part plasticity could play within the dyslexic brain. If there was a clearer physiological understanding

of the dyslexic brain, it could inform other strategies used to teach dyslexic students which could be based on the areas of the brain that are utilised to compensate for the deficit pathways.

The Link Between Phonological Processing for Language and Music

Anvari et al. (2002) hypothesized that auditory skills in language are linked to those required for processing musical sounds. They found a notable correlation between musical proficiency, phonological awareness, and reading skills in children aged 4-5. However, this age group is too young for a dyslexic assessment, typically conducted at age 7 in the UK. The study's findings suggest potential early markers, but further research with older children is needed to support and expand upon these conclusions.

Lamb & Gregory (1993) which also concluded with a small study, that the skills required for musical phonological skills correlated with reading. This older study concentrated on pitch and timbre discrimination skills. The study was only looking at 16 children and did not take into consideration the neurodiversity of the population tested. In addition, the groups came from the same educational setting. However, both studies together do give some evidence that if a child would struggle with the impairments seen in dyslexic students, there would be barriers faced when teaching music. This would have an impact on the theories we could look to within the voice studio when teaching song. Its impact to the theory of the link between musical and phonological processing is seen by the systematic review by Eccles et al in 2021, which collated a breadth of research within this area over the past twenty years. This review found that while specific impacts of various music education methods were not explicitly outlined, the review suggests that all types of music education seem to enhance early literacy skills. The review adds value by identifying factors like methodological diversity that affect the study of how music education can enhance literacy abilities. This more to up to date research draws together the theory across a wide range of sources, dating back over twenty years, which include this period of influx in research due to the influence of the No Child Left Behind Act.

In 2015, Flaugnacco, et al conducted a randomized control trial with 225 dyslexic subjects which supported the theory of correlation between music learning and improvements in students reading skills. The study used a test-rehabilitation-retest model and focused on students from Trieste and Rome, limiting the geographical scope and potentially reflecting the influence of specific educational systems. In addition, there were no comparatives made between the educational institutes the various participants attended and therefore you couldn't conclude what influence that had on the results. The trial relied on home-based learning for rehabilitation,

which varied in administration and reflected practical application supported by schools. The researchers were employed by the institutes involved, suggesting potential bias. Despite these limitations, the study supports the theory that musical awareness enhances phonological skills in dyslexic students, aligning with prior research in the field. However, given the extent of the previous work this trail was based upon and the other supporting research within the field, it would be supportive evidence to the theory of musical awareness and phonological improvements but only to the dyslexic community.

Contrary to this hypothesis, research by Stewart et al. (2003) suggests a lack of connection between speech and music processing in the brain. Using Transcranial Magnetic Stimulation (TMS) on the left frontal cortex to disrupt speech, they found that 6 out of 9 subjects experienced significant speech arrest. However, when subjects were asked to sing after speech disruption, their singing remained unaffected, indicating no disruption in sung words. This challenges the notion of a clear link between language and music processing.

However, the study's limitations include unclear subject consistency across both parts, lack of baseline cognitive function establishment, and a focus on motor rather than processing skills due to TMS targeting Broca's area. Additionally, the study did not consider neuroplasticity, which might create alternative pathways for musical processing in adulthood.

Furthermore, Stewart et al's 2003 method of experiment looked to the longer-term memory by asking subjects to recount a familiar song. A dyslexic deficit, it is specific to short term memory issue and with still unclear evidence to the dyslexic processing pathways, it would be unclear the affects that could have had on the results.

Given the strength of the studies, there is evidence to support a theory that we could hypothesis that the areas of Phonological Processing and music processing has some crossover.

Children and phonological processing

In an extension of this theory, studies including Brandt (2012) concluded that when we reach adulthood we process music more heavily in the opposing hemisphere of the area of the brain where language is processed within children's developing brains. This led to me to need to focus my research on a specific developmental age if focusing on children, as it would ensure that my strategies of music and language processing cross over are only relevant within a period of time during the brain's development on a neurological level and maintain that link between phonological processing.

Brandt (2012) reviewed a selection of studies that show that as we develop, our brains become more specialized with the areas that process music and differentiate between language and speech. Brandt (2012) did highlight that these studies either concentrated on developing brains in young children and that of adults, but there is little evidence available for older children of secondary school age. An extension of this study which looked to specify the age at which these changes happen was Wang et al, 2021. These results indicate that language specialization in the frontal lobe begins to develop in ages 7-8. Moreover, this study, along with prior research on 5- to 6-year-old children, suggests a progression in language-related neural specialization from the temporal to the frontal lobe. Wang et al (2021), had drawn from previous experiments from early age groups, although did recognise its limits on its and previous research's possible influence of cohort selection was reflective of the age specific results gained.

Looking to the UK's National Curriculum I have identified "key stage 2" as an age group I will focus further research on, **Appendix D** details these stages by age. This is as the studies above had clearer supporting theories collectively that have focused on this age group, and I can refer to the UK's National Curriculum as a base line for children in the UKs language development targets (UK Government, 2014). The UK's National Curriculum is based on periodically reviewed frameworks by Ofsted, including a series of research reviews (UK Government, 2023). However, since the same body funds both the annual review of research, and the education system, there may be a bias towards aligning research with available resources to meet national targets. Despite this, the UK's educational guidelines are comparable to those of other countries, suggesting that they accurately reflect children's developmental baselines and are less likely to be biased by funding sources.

Allowing for the aforementioned research that indicates evidence that this changes around 9 years old, by concentrating on an age group who would have surpassed the age appropriate for dyslexia diagnosis and before process pathways have begun to adapt at an older age. This is where I feel would have a wealth of research for this age group to base this work on, as there is a good understanding of a child's language development at this age with evidence to highlight what is happening at an anatomical level being consistent.

Therefore with substantial research in to the developmental stages of language learning, I could align that with the theoretical findings around the correlation between music and language processing to define my age group to focus on.

With this apparent link between language learning and musical processing in primary school aged children, I want to further my research into this possible relationship when approaching teaching strategies, expand that into established strategy for neurodiverse children in language learning to explore possible crossover for teaching song in the voice studio for dyslexic children aged 7-11.

Language Learning: Education Strategies

Given that phonological processing pathways are disrupted in the dyslexic brain, it is plausible that music processing is also affected. Therefore, a well-established teaching strategy for phonological processing in dyslexic students could be adapted for teaching music, specifically singing, to the same population.

The Orton-Gillingham Method

The Orton-Gillingham method is a widely accepted strategy for improving learning, particularly for dyslexia and broader reading difficulties (Reid & Wearmouth, 2002). It is highly structured and tailored to individual learners, based on eight key components (**Appendix E**). Despite disputes over its theories on the causes of dyslexia, modern research (Mohamad, 2021) still supports its use due to its symptomatic approach to individual needs. It remains popular in the UK and US, aligning with fundamental pedagogical principles like the Learning Triangle (**Appendix F**) and adaptable across subjects, grade levels, and teaching styles.

In 2015, further to the No Child Left Behind (2002), the Every Child Succeeds Act was introduced and has influenced the amount of research in support of this method within the neurodiverse community (Bernadowski, 2017).

Further to this, it was evidenced by Elizabeth Hethrington's lecture to the cohort that this is method is the basis of teaching amongst teachers of neurodiversity within the music teaching community and was further commented upon in her article in Music Teacher (2024).

Application of Language Learning Strategy in the Vocal Studio

Basing my strategy on treating symptoms rather than diagnoses ensures I stay within my remit as a singing teacher and avoid overstepping into educational diagnostics. This approach respects ethical boundaries and doesn't require a formal diagnosis for practical use. It offers an alternative, proven educational strategy to help students achieve their learning goals without negative impacts. Parental consent and regular assessments of learning outcomes will ensure the child's wellbeing and track progress..

Reflecting on the uses of the principles of the Orton-Gillingham method I have developed a strategy which could be used when teaching song from score to a dyslexic student displaying barriers to learning due to their symptoms. Each element of the lesson is referred back to a principle of the method, whilst being prescriptive to teaching song.

It follows a step by step structure breaking down the various elements to song learning, whilst bringing in multisensory cues. This should engage as many sensory processes as possible, without overloading short term memory processing or phonological processes which have been evident as barriers to learning within dyslexia.

In addition, The primary principles of the lesson should be adhered to:

1. Each stage is presented and mastered before building upon it in subsequent lessons, reflecting the systematic and cumulative principle.
2. The strategy is for students identified by the teacher as slower learners or diagnosed with dyslexia, emphasizing individualised instruction.
3. Teachers must adhere to the strategy to reinforce long-term memory and maintain clear, direct instruction. If the strategy causes student distress or frustration, it should be adjusted or abandoned.
4. Teachers should monitor the child's progress and ensure the instruction is comprehensible.

An example of the lesson plan to be implemented along with the Orton-Gillingham is attached in **Appendix G**. The close relationship with that of the already practiced principles within the method given the evidence of that relationship between music and phonological processing I hypothesised could provide a clear and effective strategy for teaching song in the vocal studio.

Reflection and Conclusion

Miles (2006) took an in depth view on the history of Dyslexic research, it was strongly supportive of approaching the apparent barriers in the dyslexic student, with research to practically help people, rather than understanding the physiological processes happening within the brain. I think in areas of this assignment, too much weight was given to the anatomical aspects of the research, rather than the apparent issues that would be faced in the studio. However, I think the insight into that allowed for further ideas to develop. It also allowed the research to uncover

support for an age based theory and understand the limitations of age when looking at children's language development.

It would be prudent at this point to acknowledge my own unconscious bias, this could have led to discrepancies with my search methodology which could have allowed for my searches to be unwillingly leaning towards finding supportive evidence. On reflection, given the breadth of evidence available and reviewing the search terms, they didn't look to favour arguments to strengthen my support for cross over strategies within language and music. However, It would have been better to document and create a systematic search terms list for each subject, therefore allowing for a more systematic approach to research.

On balance, the weight of evidence of the correlation between language and music processing was more conclusive with more papers available to support this than there was to oppose. Studies taking in an impartial review of research (Eccles ety al, 2021) used within this writing, supported this with their conclusions drawing to the same hypothesis.

I feel the links between language and musical processing in this age group, supports the idea of building a strategy mirroring that of the other has been evidenced with these findings. I feel further weight could be given to looking at existing singing methods, such as Kodaly which already utilises multisensory technique would have been a strong direction to explore when targeting this population.

The scope for specializing in singing lessons for dyslexic students is supported by reports from SEN music teachers and research-based lectures. Singing involves unique processes, such as creating pitch and processing written lyrics with notation, which require both auditory and motor skills. These tasks are challenging for dyslexic students due to their reading difficulties and slower response times. Further research could explore how these processes differ for dyslexic singing students, potentially strengthening connections between phonological theories and music education.

The possible impact of this work could be significant owing to the size of the population affected by this neurodiversity. In addition keeping strategy symptomatically centered will allow this work to be of further use within any population where similar barriers to learning within the singing studio.

Personal Reflection

My learnings from the approach to this will be something that will form part of my PDP **(Appendix H)** as this is an area I am passionate about due to my own experiences as a neurodiverse person. Expanding on my existing neuro-medical background as a Physiotherapist, I feel that I have the groundings to understand medical papers alongside my journey within pedagogy. I feel this puts my experience in a strong standing to explore a topic which straddles both medical and educational worlds.

Furthermore, the process of exploring further in to the barriers faced by Dyslexic brains did give me scope for further learning when approaching research as a dyslexic person, Its highlighting of Phonological processing difficulties, and how approaches to written information comprehension has lead me to reflect on my structure of studies. Again something I will explore further in my PDP and further research into better structures to my research methodology, and utilizing student support services for my academic writing.

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Appendix A

(California Department of Education Sacramento, 2018) (Duane, D. D.,2001) & (British Dyslexic Association, 2024)

Skill	Presentation in Dyslexic Students
Phonological Skills	-Difficulty in distinguishing between similar sounds or phonemes. -Problems with phonemic awareness, such as recognizing rhymes or segmenting words into their constituent sounds. –Challenges in pronouncing words correctly or in producing speech sounds accurately. -Struggles in blending sounds together to form words or in breaking words into their individual sounds.
Rapid Naming - Poor rapid naming skills refer to difficulties or delays in quickly and accurately naming a series of familiar stimuli, such as objects, colors, or symbols.	· Poor Rapid naming skills- which could present challenges in processing and integrating visual or auditory information efficiently, leading to slower cognitive processing speed and difficulty in tasks requiring quick responses. · Slow Retrieval of the correct words when writing or speaking · Difficulties distinguishing left from right

Poor grapheme-phoneme association- challenges in processing and integrating visual or auditory information efficiently, leading to slower cognitive processing speed and difficulty in tasks requiring quick responses.	· struggling to accurately pronounce words based on their spelling, difficulty in decoding unfamiliar words, · challenges in reading fluently and accurately. · may have trouble understanding the relationship between letters and the sounds they represent, which can impede their reading and spelling abilities.
Poor Decoding of real words and non-words- Poor decoding of real words and non-words refers to difficulties or inaccuracies in recognizing and understanding written language.	- Difficulty in accurately identifying and pronouncing familiar words, leading to slow or labored reading, frequent errors, or a lack of fluency. · - challenges in accurately reading and pronouncing unfamiliar or made-up letter combinations.
Reading Comprehension- Poor reading comprehension refers to a difficulty or inability to effectively understand, interpret, and analyze written texts.	· Difficulty summarizing information, answering questions about the text, or applying knowledge gained from reading.

Oral Reading Fluency- Oral

Reading Fluency refers to the ability to read a text accurately, quickly, and with appropriate expression.

- May struggle with accurately recognizing words, leading to frequent hesitations, repetitions, or substitutions while reading aloud.
- **When reading may lack** appropriate intonation, rhythm, and phrasing.
- They may read at a much slower pace, struggling to maintain a fluent and steady reading rate.
- **Difficulty with Punctuation:** Individuals may have difficulty pausing at appropriate punctuation marks, such as commas and periods, leading to choppy reading.
- **Limited Sight Vocabulary:** Poor oral readers may rely heavily on decoding words phonetically rather than recognizing them instantly by sight, resulting in slow and laborious reading.
- **Lack of Comprehension:** Because of the cognitive load associated with decoding words, poor oral readers may struggle to comprehend the text they are reading, even if they can pronounce the words accurately.
- **Avoidance of Reading Aloud:** They may actively avoid situations where they have to read aloud, such as in class or during group activities, due to embarrassment or anxiety about their reading abilities.
- **Difficulty Reading Multisyllabic Words:** Poor oral readers may have particular difficulty with longer, multisyllabic words, often stumbling over them or guessing incorrectly.

Spelling	· May often misspell words or write letters the wrong way round
Phonological Memory - The ability to store small amount of phonological information on a short term basis.	· Struggling to recall words just learnt · Struggle to recall the spelling of a word just learnt · May not be able to recall longer sequences of letters or numbers
Oral Language Skills	· Difficulties retrieving specific words which impacts their oral fluency. This can also present as having difficulties recounting a narrative or list if words orally.
Orthographic Processing- Orthographic processing refers to the ability to recognize and manipulate letters in written words.	· Dyslexia students often have difficulties in decoding words, recognizing sight words, and understanding the relationship between sounds and letters. · Difficulty organizing written and spoken language
Additional Non Language characteristics within the Dyslexic Student	
Memory and Cognition	· Poor memory for sequences especially from short term memory · Thinks in images and emotion- not words or sounds · Excellent long term memory for experiences both visually and emotionally

Behaviour	· Disorderly · Displays unusually early or late at key developmental stages as a child · Unusually high or low tolerance for pain · Emotionally sensitive · Mistakes will be affected by mood and emotion · Often creatively intelligent- Art. Music, Drama · Difficulty sustaining attention
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Appendix B

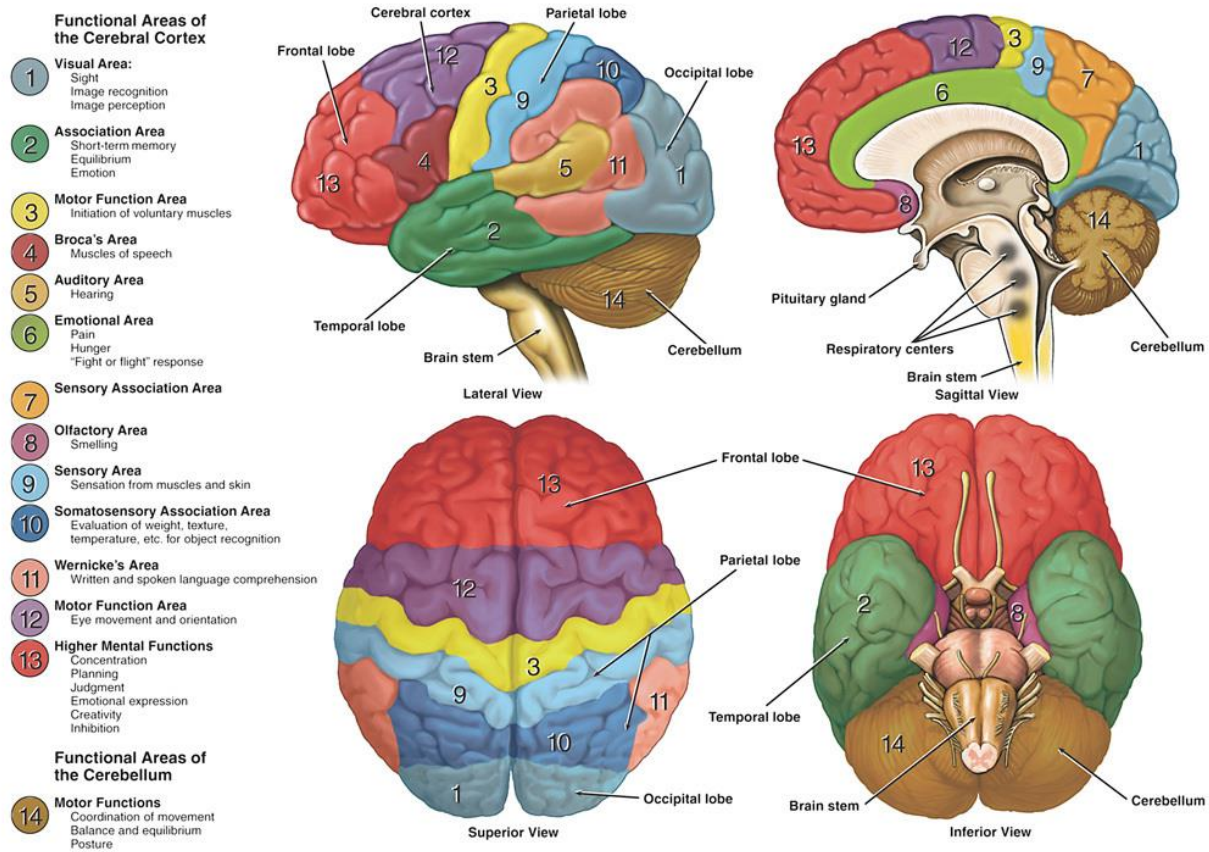
Main areas of the brain required for phonological processing in the brain (Rueschemeyer,& Gaskell 2018; Pattamadilok,C, 2017).

Area of the Brain	Role within Phonological Processing	Location within the Brain
Heschel's Gyrus	where auditory information is processed	Within the auditory cortex, in the temporal lobes of the brain.
Broca's Area:	responsible for the motor skills required for speech. While primarily associated with speech production, it also plays a role in phonological processing.	Located in the left frontal lobe
Wernicke's Area	This area is crucial for language comprehension, including the recognition of phonemes and phonological patterns.	Situated in the left temporal lobe
Arcuate Fasciculus:	It facilitates the communication between language comprehension and production areas, allowing for the processing and	This is a bundle of nerve fibers connecting Broca's area and Wernicke's area.

	manipulation of phonological information.	
Angular Gyrus	It plays a role in connecting visual information such as written word with auditory information.	This region, located in the parietal lobe

Appendix C

Overview of the Anatomy of the Brain- Dana Foundation (2023)



Appendix D

UK Government (2014)

Child's age	UK School Year	UK National Curriculum Key stage
3 to 4		Early years
4 to 5	Reception	Early years
5 to 6	Year 1	KS1
6 to 7	Year 2	KS1
7 to 8	Year 3	KS2
8 to 9	Year 4	KS2
9 to 10	Year 5	KS2
10 to 11	Year 6	KS2
11 to 12	Year 7	KS3
12 to 13	Year 8	KS3
13 to 14	Year 9	KS3
14 to 15	Year 10	KS4

15 to 16	Year 11	KS4
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Appendix E

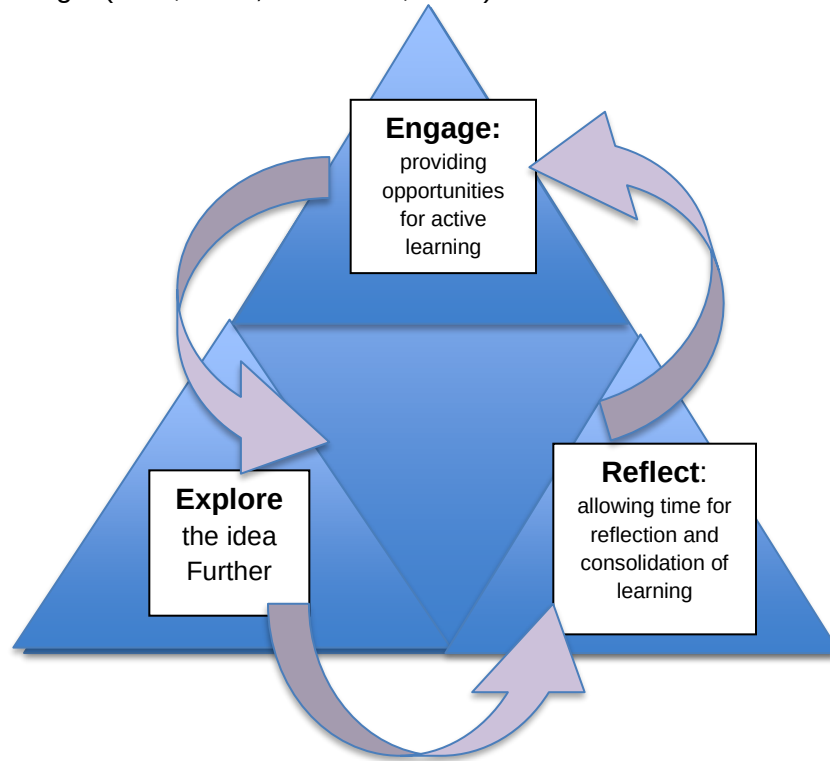
Orton-Gillingham Key Components (Reid, G., & Wearmouth, J.(2002).

Multisensory Approach:	This method emphasizes the use of multiple senses (visual, auditory, kinesthetic) to reinforce learning. Students may see, hear, and touch letters and words as they learn to read and spell.
Structured and Sequential:	Lessons are carefully structured and follow a logical sequence, moving from basic phonemes (individual sounds) and graphemes (written symbols representing sounds) to more complex language concepts.
Systematic and Cumulative	Orton-Gillingham instruction is systematic, meaning it follows a clearly defined set of rules and patterns. It's also cumulative, with each lesson building upon previous ones.
Individualized	:The method is tailored to each student's needs and progresses at their own pace. Instruction is often one-on-one or in small groups, allowing for personalized attention.
Direct Instruction	Teachers explicitly teach phonetic rules, syllable structures, and word meanings. They also provide ample practice and reinforcement to ensure mastery.
Diagnostic and Prescriptive:	Teachers assess students' strengths and weaknesses in reading and spelling and adjust instruction accordingly. This

	personalized approach helps address specific areas of difficulty.
Emphasis on Phonological Awareness:	Orton-Gillingham places a strong emphasis on developing phonological awareness, which is the ability to recognize and manipulate the sounds of language. Activities focusing on phonemic awareness, syllabication, and word analysis are common.
Continuous Assessment	Teachers continuously monitor students' progress and adjust instruction as needed. This ongoing assessment ensures that students receive the support they need to succeed

Appendix F

The Learning Triangle (Reid, 2016; Mohamad, 2021)



Appendix G

Lesson Plan example for Key stage 2, learning song through mirrored Orton-Gillingham Methods

Stages of the lesson	Principals of Orton-Gillingham Method observed
Colour code the lyrics into verse and chorus on paper	Structured and Sequential
Ask the student to identify the patterns in parts that mirror each other (the visual stimuli of the broken down song will allow to break the information into small sequences and finding the similarities cuts the amount of sequencing required)	Multisensory Approach
Listen to a recording of the melody or sing the full song without lyrics following the shape of the score (auditory, whilst limiting the phonological input)	Multisensory Approach
-Using their hand to follow the pitch of the melody as it moves along whilst listening to the played melody (brings in a kinesthetic approach to learning)	Multisensory Approach
-Then physically touching the score follow the melody with their finger (additional multisensory element to the learning)	Multisensory Approach

-Lines of the melody should be taught be call and response. The teacher should follow on the score with their finger the notes being sung to 'Ah or La' in place of the lyrics, ask the student to repeat this until they have accurately recalled the melody along with accurately following the notes sung. A line should be taught and then the following line should be taught in isolation then with the previously learnt sections together. This allows the brain to	Multisensory Approach Systematic and Cumulative Structured and Sequential
Once the melody has been learnt, the lyrics should be taught in a similar manner to the melody with an emphasis on the syllabic pattern followed by the notation. The lyrics are to be sung to the student following the score with a finger, like the melody learning this should be done a line at a time, individually then added to the previously learnt melody and lyric collective. The Auditory process of the singing teacher singing the note to the student.	Multisensory Approach Systematic and Cumulative Structured and Sequential
The song should be sung in full, once through with the singing teacher singing as an auditory support, following the score with a finger. If the student gets a part wrong, this should be stopped at the point of error, sung correctly and the section should be repeated until it's accurate then, return to the start of the song to repeat the exercise	Multisensory Approach Systematic and Cumulative
Once the student has evidenced they can sing the song in full accurately with the teacher, the student still following the music with their finger should repeat the song until they can sing the song in full without auditory support, following the rules above if errors occur. Once this has been achieved the need for following score with their finger should be removed and repeated	Multisensory Approach Systematic and Cumulative

Appendix H

Personal Development Plan- Jessica Sanchez (Bray) - April 2024

Goal	Development Opportunity to meet my Goal	Actions I will take to achieve this	Resources and Support needed	What Success will look like	Date of Completion
Connect with the wider Neurodiverse Music Teaching community	To increase my knowledge of existing research and strategies in use amongst teachers of neurodiverse students	-Write an email to Elizabeth Hetherington who led a Voice Study Centre to ask for a possible Zoom meeting -Arrange a zoom meeting with Elizabeth to discuss her theories from the lecturer to gain insight in to her research and to find any other possible studies or journals to read to further my knowledge in existing Music Teacher theory within Neurodiversity.	-contact email for Elizabeth from the Vocal Study Centre -Finding Time within mine and Elizabeth's schedule to coordinate a meeting -Agenda for the meeting with Elizabeth to ensure aims of the meeting are met	-Will have met with Elizabeth Hetherington -A list of neurodiverse specific education journals to read -A list of research Elizabeth used for her methods	September 2024
Develop a better understanding of Neuroanatomy of the dyslexic brain	To increase my knowledge of neuroanatomy to better understand the research papers that I am reading to gain a better understanding of Dyslexia, which I am exploring within	-Search the Voice Study Centre for any neuroanatomy courses -schedule time for and watch the videos found -research further neuroanatomy courses available	-I will have watched any relevant videos found on the VCS library -A neuroanatomist	-I will be able to map from memory an anatomically accurate map of the parts of the brain	August 2024

	my research to build teaching strategies within this population	online -Contact any lecturers within the VSC videos for any further reading which would be useful to help understand the -Revisit my previous Neuroanatomy books from my Physiotherapy Degree	omy Guide to the areas of the brain discussed in Module 1, either via a source recommended by a lecturer -Request a Neuroanatomy book from the library -I will schedule 3x 1 hour long sessions to revise and learn my objectives set out.	required for phonological processing -I will be able to name the key areas of the brain mentioned within Module 1, and be able to recall what their functions are	
Extend my knowledge of teaching Neurodiverse students	-To gain further insight into other theories of teaching specific to music and increase my awareness of research already undertaken which could be applied to my research	-Subscribe to the Music teacher magazine updates to find any Neurodiverse specific articles -Research Educational journals specific to teaching Neurodiverse students -Research available publications through the university library	-Access to the university library -Subscription approval to journals -Request any possible routes to publications open to me	-I will have identified the key journals and subscriptions that would fit the category of knowledge wanted in this area -Read relevant journal	Made Routine to my learning schedule by August 2024

			through my university library	articles when they are published within a month of publication of subscribed journals -Monthly reviews of the subscribed journals to identify relevant articles	
Understand the barriers faced when completing assignments due to my dyslexia	-To find additional support and understand the possible barriers I am facing due to dyslexia to help improve my academic writing	-Book regular catch ups in the run up to my assignment due dates with tutors -Book a meeting with the University student support team to get clarity on the support available through the university	- Scheduled dates of due assignments -list of tutors in relation to make next assignment -University Student support availability and funding in place from the SLC	-created a better methodology to research and comprehension of text -adapted study schedule adapted to additional support advice -arrange 1:1 student support sessions with academic tutor	Oct 2024
Explore the relationship	-To understand if there are research papers to support	-Conduct a search of singing and music teaching journals for	-Search for any neuroanatomy	-I will be able to map the	-October 2024

p between singing processes in the dyslexic brain	any changes in the processes within the dyslexia when specifically looking at act of singing song from score	any prior research -Find academic texts to understand the neuroanatomy involved in singing -create any comparisons across the typical and atypical brain	omy lectures within the course led library -search for further reading within the university library collection -seek recommendations from tutors of nuerospec ialists in singing and explore their work	neuroanat omy processed used for singing -I will be able to map any difference s seen between the typical and atypical brain -To bring this understand ing into further research on this subject within my own academic writing	
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