A COMPARATIVE ANALYSIS OF BREATHING RATES OF STUTTERERS AND NON-STUTTERERS

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Declaration

I declare that this thesis is original and contains legit information except where states otherwise by reference or acknowledgment, the work presented is entirely my own. I further declare that this thesis has not been submitted, in whole or in part, in any previous application for another degree in any university.

Signature: _____ Date: _____

Certification

This is to certify that this thesis has been read and approved as having met the requirements of the department of English in the Faculty of Humanities, National University of Lesotho for the award of Master of Arts Degree in English Language and Linguistics.

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Dedication

This thesis is dedicated to stutterers, friends and family members of stutterers, parents, profit and non-profit making organisations and people interested in the nature of stuttering. The origin and nature of stuttering is still a mystery even in the 21st century. Understanding how stutterers struggle in their daily lives can help eradicate the humiliation that stutterers face in different environments by different people.

To my late mom and sister, your absence in my life has been a sorrow and the reality that you are no longer with me depresses me. Despite the sad reality, bearing in mind that I am the last hope of the family pushes me even to the points and edges that I never thought I will go through. In order for me to represent my family, I will always be strong to swallow blood and saliva. I know this is possible through Christ who gives me life, strength and wisdom. I love you Mama and Palesa!

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It is through all people that I encountered and shared my ideas with that I realised that this work is no longer my own, but it is for everybody interested in stuttering research to make a difference.

List of acronyms and abbreviations

ALSHA – American Speech Language- Hearing Association

Bp – blood pressure

Bpm – breathe per minute

Br – Breathe

CNS – Central Nervous System

FS – Female stutterer

HCRI – Hollins Communications Research Institute

MFP – Multi-Factorial Polygenic

MLU – Mean Length Unit

MS – Male stutterer

NIDCD – National Institute on Deafness and other Communication Disorders

NUL – National University of Lesotho

PDS – Persistent Developmental Stuttering

PWS – People With Stuttering

SAAD – Simple Active Affirmative Declaratives

SML – Single Major Locus

Temp – Temperature

US – United States

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Abstract

This set out to establish whether or not there is any relationship between breathing rates and stuttering so as to propose a way forward eliminating stuttering. The observation that *there is no stuttering during singing* motivated the current study to assess the breathing rates of stutterers and non-stutterers both during singing and speaking. The findings of this study reveal that the two groups (stutterers and non-stutterers) use different breathing rates when singing and speaking. Therefore, the current study suggests that it is possible to reduce or eliminate stuttering through regulated breathing rates depending on the severity of the problem and the breathing pattern. The aim of the current study was to identify and assess the breathing rates of stutterers and non-stutterers to see if there is a difference so as to recommend the breathing range for stutterers. Based on the findings and observation of this study, breathing ranges are proposed for stutterers as an attempt to reduce and/or eliminate stuttering. It is the hope of the researcher that further studies will be done in this area to create more awareness in relation to the phenomenon of stuttering, as well as to provide long lasting solutions to eradicate stuttering.

CHAPTER ONE: GENERAL INTRODUCTION

1.1 **Background to the study**

Stuttering is a language disorder that is believed to affect all language groups and can be traced to have been with people since they first began to speak (HCRI- Hollins Communications Research Institute, 2001). Stuttering is found in all parts of the world and in all cultures and races indiscriminate of occupation, intelligence, income, sex, and age (Yairi and Ambrose, 2013). Like other continents with stuttering research centers and associations, Africa has also taken part to form organisations regarding stuttering though the rate at which the African countries are participating is very low (Nsabimana, 2015).

The African Stuttering Research Center (ASRC) is located in Kigali Rwanda and only eleven countries are part of it out of fifty nine countries: Burundi, Rwanda, South Africa, Burkina Faso, Mali, Niger, Democratic Republic of Congo, Tchad, Togo, Tanzania and Central Africa Republic (Nsabimana, 2015). According to Nsabimana (2015), South Africa dominates these participating countries in that it has more clinics, therapists and organisations regarding stuttering. It is therefore, the objective of the ASRC to see most of the African countries participating because stuttering exists among people but with proper treatment it can be managed.

The origin of stuttering according to HCRI (Hollins Communications Research Institute) (2001) has been traced as an issue that has been with people since they first began to talk and the problem is a worldwide issue that occurs in all language groups. The HCRI (2001) believes that stuttering has generated its own myths and superstitions, yet its cause remains a mystery. Some

of the believes and myths about stuttering are that stutterers stutter because they are possessed with demons or that people who stutter are less intelligent than others (Stuttering Foundation, 1991). In addition, Jonas (1979) suggests that some authorities like Aristotle, the Roman physician Celsus, the Greek physician Galen and the Prussian surgeon Johann Friedrich Dieffenbach believed that stutterers stutter because they have thick, hard, weak, wet, cold tongues.

Despite the myths and believes associated with stuttering, it has been defined in different ways by various scholars. One of such definitions is that of Barry (2005:10) who states that "stuttering is a speech disorder in which the flow of speech is disrupted by involuntary repetitions and prolongations of sounds, syllables, words and phrases." He further adds that, stuttering is sometimes called stammering or disfluency and the person who stutters or stammers is called a stutterer or sufferer. Buchel and Sommer (2004) clarify that stuttering is a symptom not a disease but the term stuttering usually refers to both a disorder and a symptom.

In linguistics, it is common knowledge that *there is no speech without air*. This suggests that air plays a fundamental role in speech production. Therefore, this research assesses the breathing rates of stutterers and non-stutterers when they speak and sing which links to the idea that air is the crucial element in production of speech sounds. Rate is "a measure, quantity, or frequency typically measured against other quantity or measure" (Oxford dictionary, n.d). Field (2004) argues that stuttering varies considerably between sufferers resulting in severe and mild stutterers. He suggests that sufferers are often aware of their limitations and they may paraphrase or use general terms to avoid words which they anticipate will be difficult for them to utter. He specifies that this can however, be used as a self-therapy for stutterers.

1.2 **Relationship between language and stuttering**

It is crucial to first understand what makes *language a language* by looking at the origin of language. The language concept has been addressed as the most challenging concept to trace and Yule (2010) in addressing this concept admits that

> *"We simply don't know how language originated. We do know that the ability to produce sound and simple vocal patterning (a hum versus a grunt, for example) appears to be in an ancient part of the brain that we share with all vertebrates, including fish, frogs and other mammals."*

This background of the origin of language is provided to better understand the origin of stuttering. The origin of language according to Yule (2010) is however, defined through six views: divine source, natural sound source, social adaptation source, physical adaptation source, genetic source and the tool making source. The relationship between linguistics and stuttering is that stuttering is defined as a speech disorder characterised by repetitions and prolongations of sounds, syllables, words and phrases which in this case are better explained in linguistics than other fields. Packman, Langerin and Onslow (2009:1) state that "…for centuries, people have attempted to explain stuttering in terms of a medical model but failed." It has been suggested that stuttering is a sign of some underlying physical or psychological pathology; however, the theoretical explanations of stuttering have implicated linguistics, cognitive, emotional, behavioral and neurophysiological factors (Packman *et.al.,* 2009). This is to say that in the former times, stuttering was more associated with the medical terms but recently stuttering is easily associated with other areas which are believed to have close links with it. To support this,

Jeremy (2011) states that the recent understanding about stuttering is that it is a highly heritable disorder.

Packman *et.al* (ibid) on the other hand state that stuttering is described as the linguistic-motor interface because the disorder of stuttering represents a breakdown at the point where linguistic processing is transformed into speech production. They further suggest that an explanation of stuttering must account for both linguistic and motor aspects of speech. In this regard, it can be assumed that stuttering is the intermediator of the motor impulses from the brain and the speech articulators. In relating stuttering to one discipline of linguistics; phonetics, Zmarich (2014) declares that phonetics is a borderline discipline and it holds a privilege key for unifying and simplifying the understanding of stuttering that presents itself as a multidimensional phenomenon. He adds that phonetics is a borderline discipline in that it has a theoretical, applicative character and it is at the convergence of different scientific realms amongst others linguistics, physics, biology and psychology.

Danny, Negata and David (2001) indicate that speech sounds are differentiated from other types of sounds including music, animal sounds and noises. Danny *et.al* (ibid) suggest that the two hemispheres of the brain (the right and left) specialise in processing these types of sounds. They state that for the true right-handers, speech sounds are processed in the left hemisphere of the brain while music, animal sounds and other noises are processed in the right hemisphere. This is possible because of the nature of the arrangement of large and small bundles of fibres that for right-handed people, the lateralisation of language in the left hemisphere will perceive speech sounds more readily through the right ear than the left ear. The big bundle of fibres from each ear will cross over to the other hemisphere and a small bundle of fibres will go directly to the nearby hemisphere. The left hemisphere however, specialises in language, logic, analytical operations

and mathematics while the right hemisphere specialises in recognising emotions and perceiving the structures of things globally without analysis. Although the two hemispheres specialise differently, Dany *et.al* (ibid) argue that the new research shows that the right hemisphere has some language functions and can take over the complete language functioning of the left hemisphere when the left hemisphere has been surgically removed or damaged.

According to Ekanjume-Ilongo (2015) the speech sounds result from the obstructed air in three main processes being airstream process, phonation process and the oro-nasal process. This suggests that it is possible to assess the breathing rates used for singing and speaking in linguistics area because respiration is amongst the primary basics of speech production. Ohala (1990) adds that speech consists primarily of the articulators transforming the pressure variations created during respiration into pressure variations or sound. He further adds that the anatomy of respiration involves getting oxygen into and carbon-dioxide out of the lungs which are the two sponge-like lobes having great internal surface area in order to facilitate gas exchange. He indicates that it is possible to have more than one dozen of muscles to get involved in respiration under certain conditions including the trunk muscles, but the primary muscles are the internal and external intercostal muscles, the diaphragm and the various sheets like muscles covering the abdominal cavity.

1.3 **Singing anatomy**

Singing on the other hand is produced differently from speech as indicated by Danny *et.al* (2001) that the two hemispheres of the brain are responsible for different sounds. According to Farmer (2014:18) singing is "the act of producing musical sounds with the voice and the augments regular to speech by the use of both rhythm and tonality." Dahm (2012) declares that when

people sing, the intention is to come up with a voice that has a sequence of different vocal tones. He adds that this sequence makes the melody of the song which comes from the brain. The motor area sends signals to the muscles of the larynx so that they will vibrate with the right pitch and rhythm. Dahm (2012: 1) suggests that "if you want to see this yourself, sing a song silently." This statement means that people should notice what is happening in their throats and they will sense that the vocal folds are ready to vibrate though the person singing wants to remain silent. The brain sends these signals automatically whether one is silent or loud. When a song contains the lyrics (the words of the song), nothing changes. He believes that speech sounds are formed automatically without any thought or effort. However, Sherman, Gawronski, Gonsalkarale, Hugenberg, Allen and Groom (2008) argue that there is a distinction between automatic processes and controlled processes.

Parilis (2014) indicates that singing is just a melodic form of speaking not that singing is different from speaking. It is true that when people sing, more focus is on melody and rhythm than on speaking though the most important thing in singing is melodic speaking because speaking and singing use the same articulators (Parilis, 2014). Dahm (2012) claims that it is often thought that no one stutters when singing, but he has observed a few exceptions. Hear (1979) notes that there is reduction of stuttering during singing not that there is no stuttering at all when singing. This is supported by Dahm (2012) where he states that "Of the thousands of people who I have either evaluated or treated, a handful has stuttered occasionally when singing particularly when starting to sing."

1.4 **Breathing anatomy**

The last aspect to be tackled is the respiratory rate of the human being. According to Eldridge (2018) respiratory rate is the number of breaths a person takes in a minute. She further indicates that the respiratory rate should be measured when a person is at rest not after a certain activity such as walking or running. The number of the breaths people take per minute is a sign of how often the brain instructs the body. Drost, Mclvor, Nicole and Yuan (2013) declare that the respiratory rate is a vital sign with an underappreciated significance that can in acute situations predict the patients' mortality rate and need for invasive ventilation. They add that as much as the respiratory rate is that crucial, identifying abnormal breathing patterns can localise disorders within the respiratory system and help refine different diagnosis.

However, different experts have different ranges regarding examination of the normal and abnormal breathing rates. The case of the range provided by Drost *et.al* (2013) suggest that the normal breathing rates for adults range from 12-20 breaths per minute while Eldridge (2018) suggests 12-18 breaths per minute. However, Eldridge (2018) suggests that decreased and increased breathing rates present a sign that something is amiss in the body though it is fairly non-specific. According to her, higher respiratory rates can be triggered by fever, dehydration, asthma, hyperventilation as a response to stress, pain, anger and panic attack while decreased respiratory rates are triggered by alcohol, narcotics, metabolism and brain conditions.

However, there are breathing pattern disorders which are symbolised by over-breathing where the depth and rate of the breathe are in excess of the body's needs (University Hospital Southampton, 2017). The breathing rate is very crucial in a person's life and it should be measured in combination with the heart rate, blood pressure, temperature and oxygen saturation for better results (Kelly, 2018). According to University Hospital Southampton (2017), coordinating breathing while talking is a common problem in breathing pattern disorders because

speech interferes with the background rhythm of breathing. It further indicates that some people experience difficulties with voice projection, vocal tone, tight throat while talking or the voice fading out. It further provides a technique for breathing during speech that in order to obtain good speech control it is important for one to continue to use the abdominal low-chest breathing patterns. The technique is therefore to "take a relaxed deep breath out before speaking, breath in softly through the nose to start and speak slowly" (University Hospital Southampton, 2017:1). This is because the common cause of breathing disorders are over expanding the upper chest when starting to speak, forgetting to pause for breath during speech or speaking to the very end of the breath followed by a gasping breath.

1.5 **Statement of the problem**

The solution for people who stutter is the regulated breathing rate after the pioneers of this model Azrin and Nunn (1974) identified that the regulated breathing rates actually decrease stuttering. However, it does not provide the recommended range of breathing rates for stutterers. The present study which is a comparative analysis therefore intends to bridge the gap by assessing the breathing rates of stutterers and non-stutterers in order to come up with the possible range appropriate for stutterers' breathe during speaking in relation to eliminating their stuttering issue. The observation by the present researcher is that *there is no stuttering during singing*. However, Parilis (2012), Hear (1979), and Dahm (2012) clearly indicate that there is reduction of stuttering when singing not that there is no stuttering at all. The features of singing as observed by the researcher include regulated breathing rates, tone, rhythm and rehearsals; as opposed to speech, where there is no rehearsal, no regulated breathing rates and occasionally tone and rhythm in some languages. Looking at the characteristics of singing and speaking, the common feature that can be managed is the breathing rates perhaps; this is why the previous studies have suggested

regulated breathing rate as the solution for stuttering. This leaves us with the question of: what is the difference in breathing rates for stutterers and non-stutterers during singing and speaking?

1.6 **Research questions**

The unique behavior (reduction of stuttering when singing and occasional stuttering when singing) of stuttering is indeed the one that raised the following research questions:

i) Do stutterers and non-stutterers use different breathing rates when they sing and speak?
ii) Can the breathing rates be blamed for the occurrence of stuttering for stutterers?
iii) Is there any specific environment that makes stutterers to stutter more or less?

1.7 **Hypotheses**

The characteristics of stuttering by Field (2004) include blocking of the airflow and running out of breathe while talking which in this case can be assumed to have a negative impact on the breathing rates' pattern. Meanwhile, the Dictionary.com (n.d) suggests that speech occurs at lower oral intensity, great energy, strength and concentration levels than singing. Therefore, the study assumes that;

i) Stutterers and non-stutterers use the same breathing rates when they sing and when they speak despite the blockages and running out of air while talking.
ii) The same breathing rates during singing and speaking for stutterers and non-stutterers would mean that the breathing rates cannot be blamed for the reduction of stuttering.
iii) The environment does have an impact on stuttering.

1.8 **Objectives of the study**

The objectives of this study are to;

i) Identify and assess the breathing rates of stutterers and non-stutterers when they speak and sing.

ii) Add on the already existing literature that there is reduction of stuttering during singing.

iii) Recommend the appropriate breathing rate range for stutterers.

1.9 **Justification of the study**

Although Dahm (2012) and Parilis (2012) already assessed that there is reduction of stuttering when singing, the current study aims at assessing the exact breathing rates of stutterers and non-stutterers when singing and speaking so that the exact difference in numbers can be identified and assessed. The normal breathing rate range according to Eldridge (2018) is 12-18 and 12-20 according to Drost *et.al* (2013). Therefore, the study introduces the operational breathing rate range which is 12-20 in line with Drost *et.al* (2013). The present study will reveal the exact range or number difference for the stutterers and non-stutterers' breathing rates assessed during both activities if any. Where there is discrepancy in the breathing rates range, the study will bring a new angle regarding stuttering and recommend the breathing rates for stutterers in order to reduce stuttering issue; although each stutterer will be treated differently based on the severity of their problem and the range of their breathing rates. On the other hand, however, if there is no difference in the breathing rates of stutterers and non-stutterers during both activities, then this will indicate that the breathing rates cannot be claimed for the reduction of stuttering. The

findings of this study will be used in Linguistics field and Health sciences to further add value to the previous studies conducted on stuttering.

1.10 **Significance of the study**

This study will be beneficial to stutterers because they will understand the nature of their problem better, regarding the breathing rates assessment when they sing and speak. The study will also be beneficial to researchers including the current researcher in that researchers in different areas of study such as linguistics, speech therapy, speech pathology, health sciences and psychology can further this research or they can use the results of the current research to add value to previous studies on stuttering that have been conducted. The study further influences policy makers to beware that stuttering is a language disorder and people who stutter should be treated as fairly as non-stutterers. For instance, in the case of the interrogation of a police officer and a stutterer or during an oral interview with a stutterer. The study will also be crucial to interested people who are willing to learn and understand the nature of stuttering, singing, speech and respiration.

The study will further be important to lawyers and investigators in Lesotho by revealing that all people are capable of being *'temporary stutterers'* under certain conditions such as anxiety, and fear. Therefore, it can even be more challenging for stutterers to provide evidence in certain awkward moments. Profit and non-profit making organisations such as schools, government, churches and other work areas in Lesotho will also benefit in that, there is no scientific evidence that says people who stutter are less intelligent than others. As a result, stutterers should be given time to express their ideas and emotions like any other human being, because their non-fluent speech does not suggest that they are out of ideas or stupid.

1.11 Scope and Delimitation

This study is correlational in nature because it is non-experimental in which the researcher measures two variables and assess the statistical relationship between them with little or no effort to control extraneous variables (Siegle, 2015). The correlation study according to Siegle (ibid) is used to determine the extent to which variables are related and it is a research that has a direction. In this study, the statistical relationship will be for the variables when stutterers and non-stutterers sing and speak which will be used to determine the relationship between the two activities, stuttering and respiration. There is however a direction in that the range for the breaths per minute will be used to identify normal and abnormal breaths per minute during both activities.

1.12 Conclusion

This chapter introduces the basic elements of the entire study: stuttering, respiration, speech production and singing. The chapter further shows that in order to produce speech and singing, the air plays a fundamental role and that stuttering as a speech disorder, definitely occurs during speech delivery. In order to determine if stutterers and non-stutterers use different breathing rates during singing and speaking, a correlational study is mandatory; this is exactly the scope of the present study. Based on the objectives of this study, the results will be used to add, improve or introduce a new concept on the already existing literature concerning stuttering and respiration.

CHAPTER TWO: LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 Introduction

This chapter looks at previous studies on stuttering, breathing, singing and speaking. The chapter focuses on the origin of stuttering, the cause and characteristics of stuttering as well as the theories of stuttering, stuttering effects, stuttering treatment, theories of speech production, the anatomy of singing, breathing physiology and linguistic effect. The linguistic effect of stuttering is also mingled in the four major areas of the study (stuttering, breathing, singing and speaking) together with the relationship of this study to other related studies. The last aspect is the conclusion summarising the entire chapter. Strictly speaking, stuttering is a symptom not a disease but the term stuttering refers to both the disorder and symptom (Buchel and Sommer, 2018).

Stuttering is a fluency disorder with complex origins: genetics, neurophysiology and environment (Barlow and Durand, 2005). Eske (2019) stipulates that stuttering is referred to as muscular tension appearing at the beginning or during the act of speaking. Buchel and Sommer (2018) note that stuttering has been known for centuries and the earliest descriptions probably date back to the Biblical Moses 'slowness of speech and tongue and his related avoidance behavior (Exodus, 4:10-13)'. They further note that stuttering occurs in all cultures and ethnic groups. In mild access of stuttering, the tensions are usually limited to those muscles which are directly concerned with speech, that is, the muscles of the lips, jaws, tongue and throat. In severe cases of stuttering, excessive tension may also be seen also in muscles of the face, neck,

shoulders even arms and legs Backus (1948). Despite the extensive research, Dandurant (2019) clarifies that the causes of stuttering remain largely unknown.

Stuttering is present in all cultures with a prevalence of around 1% of the population worldwide. While there has been extensive brain and behavioral research into stuttering over the last 50 years, its cause remains unknown (Buchel and Sommer, 2018). Research on brain has shown anomalous activations during stuttered speech and more recently, has identified structural anomalies in the speech language areas of the brain (Codea, Packman and Onslow, 2007).

Some observers argue that since stuttering has not been shown to have a physiological basis, it must be sought in the unresolved conflicts of early childhood (Jonas, 1979). Jonas further notes that just as certain people express their neuroses through sick headaches, and others by eating too much, the stutterer may have deep seated personality problems that find expression or rather non expression in speech blocks and repetitions.

Buchel and Sommer (2018) disclose that over the centuries, a variety of theories about the origin of stuttering and corresponding treatment approaches have been proposed. In the ancient Greece, theories referred to stuttering as dryness of the tongue; in the 19th century, abnormalities of the speech apparatus were thought to cause stuttering and in the twentieth century, stuttering was primarily thought to be a psychogenic disorder. Other theories regard stuttering as a learned behavior resulting from disadvantageous external, usually parental, reactions to normal childhood dysfluencies (Johnson 1955). While this model has failed to explain the core symptoms of stuttering, it may well explain secondary symptoms and guided early parental intervention may prevent persistence into adulthood (Onslow, Packman and Menzies, 2001). Ambrose and Yari (2013) state that in the twenty-first century, the epidemiological advances in

stuttering research are reviewed within the perspectives of past knowledge and in their study, they reviewed six sections: onset, incidence, prevalence, developmental paths, genetics and subtypes of stuttering.

In trying to account for the known facts about stuttering without playing down individual and cultural differences, some researchers have emphasised that stuttering is essentially a learned behavior, a speech habit ingrained in a child as a result of certain childhood experiences and periodically reinforced during normal social intercourse, (Jonas, 1979). Taking cues from Ivan Pavlov and B.F. Skinner, Jonas further notes that a number of behavioral therapists have recently attempted to cure stuttering by breaking the old patterns of reinforcement.

The origin of stuttering describing it in three angles (genetics, neurophysiology and environment) will help the current researcher to ask the stutterers as to how they think they got this speech impairment. The analysis will add or bring new information to the already existing one on the origins or types of stuttering.

Sundberg (1992) notes that by experience, he believes that voice therapists and singing teachers know very well that an efficient way to improve phonation is to improve the breathing technique. Phonation requires that the air pressure inside the lungs is raised. This air pressure serves as the main physiological control parameter for vocal loudness: the higher the pressure, the louder the voice (Sundberg, 1992). The elevation of the lung pressure, henceforth the sub-glottal pressure, is achieved by decreasing the volume of the rib cage, in which the lungs are hanging. There are three different forces that contribute to this volume: muscular forces, elasticity forces and gravitation (Sundberg, 1992).

However, in normal speech, the compensatory work, required in order to balance the passive expiratory forces of the rib cage and the lungs, is handled primarily by the inspiratory intercostal muscles; some researchers have found that the diaphragm, the other main inspiratory muscle, is passive in speech (Sundberg, 1992). As the range of lung volumes used in speech is comparatively narrow, the elasticity forces are rather limited. Singers, on the other hand, use a much greater lung volume range and therefore have to handle much greater variation of elasticity forces. Hence they need to change sub-glottal pressure with great skill.

Sundberg (1992) notes that the apparent difference among singers can be found in the positioning of the abdominal wall because some singers sing with their abdominal wall expanded others sing with the abdominal wall pulled in. The arguments used in favor of these strategies are sometimes quite entertaining. For instance, some voice teachers find support for the belly in (the abdominal wall pulled in) method in the fact that this strategy is apparently used by barking dogs. Sundberg (ibid) further augments that it is surprising that such arguments sometimes are taken seriously in spite of the apparent dissimilarities between the voice sound of a good singer and the voice sound of a barking dog.

According to Lander (2010) phonation attributes all vocal vibration to the impact of air on the vocal folds. However, people do not consciously expel breath to get their voice going when they speak. The normal speech requires a nearly undetectable quantity of air, especially in comparison with singing (Lander, ibid). Knowing the detectable quantity of air during speaking can perhaps help stutterers to control their breathing rates and patterns which is the aim of the present stud Lander (ibid) believes that speech originates with the impulse to say something. She notes that one of the things that impulse does is mobilise the breath, but speech does not originate with the breath. Lander (ibid) reveals that the vocal pedagogy books credit the breath with generating the

sound. She notes that the air flows through the vocal folds, causing them to vibrate and produce sound, after which the pharyngeal, oral and nasal cavities contribute resonance.

On the other hand, according to Lander (ibid), the thoughts and feelings are what make the voice go. They do this in part by making the breath go. One's thoughts and feelings are the real generator as far as the vocal instrument is concerned. People can produce all manner of vocal sounds by manipulating their breath directly, but only singing motivated directly by their thoughts and feelings will communicate to them effectively.

Therefore, Lander (ibid) suggests that the best way to learn about phonation is to investigate the way one's own thoughts and feelings give rise to speech, particularly when one express their self with intensity and passion, when there is no chance for self-censoring impulses to kick in. In order to achieve all these, according to Lander (2010) people should note that:

- In spontaneous communication, people think, feel and gesture BEFORE the voice engages
- People do not run out of breath in the middle of a sentence. What they intend to communicate motivates them to take in the precise quantity of breath they need to get the sentence out.

The last bullet can be argued in that in the case of stutterers, they usually run out of breath while talking in some instances. In fact, running out of breath while talking, is one of the characteristics of stuttering as noted by Field (2004).

2.2 Causes of stuttering

According to National Institute on Deafness and other Communication Disorders (NIDCD) (2017) the precise mechanisms that cause stuttering are not understood and stuttering is commonly grouped into two terms: developmental and neurogenic stuttering. Buchel and Sommer (2018) indicate that as many as the steps in how people produce language normally is still a mystery, disorders like stuttering are poorly understood though genetic and neurobiological approaches are recently providing clues to causes and better treatments of stuttering.

According to Mayo (2014) medical conditions and mental health problems are causes of stuttering, stroke, emotional trauma, and injuries in the brain. Abnormalities in the speech motor control of the brain can cause acquired stuttering on conditions that the lesion occurs on the particular region essential for fluent speech (Borsel and Taillieu, 2001). When the speech motor control is too slow to process, this leads to the speech dysfluency hence, stuttering (Borsel and Taillieu, ibid). The Centre Grove Community (2009) suggests that stuttering is mostly accompanied by tension and anxiety. This means that when stutterers are tense and anxious they even stutter more. Schneier (1997) states that stuttering is accompanied by many negative consequences across a person's lifetime which can increase social withdrawal and psychological difficulties. Children and adolescents who stutter often experience social isolation and rejection (Blood, Blood, Tramantana, Sylvia, Boyle and Motszsko, 2011; Davis, Howell and Cooke, 2002).

Mayo Clinic (2014) suggests that stuttering is caused by abnormalities in the speech motor control in the brain and the evidence indicates that this is caused by poor timing, sensory and

motor coordination. It is believed that damage to the fluency part in the brain leads to speech disfluency, stuttering. The other causes of stuttering are the genes because stuttering runs in families as a result of inheriting abnormalities in the language centers of the brain.

Nevertheless, Field (2004) states that cluttering sometimes occur in conjunction with stuttering. This is because one possible cause of cluttering is brain damage on the speech fluency area in the brain. According to Field (2004) cluttering is the fluency disorder in which the sufferer attempts to speak too quickly resulting in distorted articulation and disrupted rhythm. He however, adds that with cluttering, syllables are shortened, words are repeated and sounds are omitted and misarticulated. He suggests that planning at the phonetic level for cluttering is implicated (mixed up) that it is uttered in staccato bursts (sounds are shortened and separated when speaking) which sometimes interfere with syntax and when the utterance proceeds, the speaker may speed up (festination) rather than slow down. His view is therefore, beneficial to the researcher to differentiate stuttering from cluttering in relation to selection of participants in this study.

The causes of stuttering in general according to Hunt (1870) are intrinsic, extrinsic and functional.

1 Intrinsic causes of stuttering

Hunt (1870) states that the chief intrinsic causes of stuttering are morbid affections of any part of the vocal or articulatory apparatus. Other causes according to Hunt may be enumerated: defects of the lips which may be too short, too thick, too rigid, too distant from the teeth or hare-lip; defective position of the teeth, disproportionate size of the lower jaw, stiffness, approximation of the same, apertures or fissures in the hard or soft palate, abnormal length, thickness, or absence either of the velum or of the uvula, nasal cavities constricted or obstructed by polypic,

inflammation, cold in the head, inflammation or enlargement of the tonsils, excessive or defective length, breadth, thickness, or laxity of the tongue, loss of the whole or part of the same by cancerous diseases; abnormal fixture of the tongue to the fraenum; tumors on the tongue or in the buccal cavity.

The recent work of Kollbrunner, Seifert, Wedell and Zimmermann (2014) indicate that despite the huge body of knowledge about stuttering, its cause is still considered to be unknown. They further note that the psychological background is recognised as important, but stuttering is currently regarded as a pure neurological problem. They note that it is generally agreed that therapy should be multidimensional but in fact there is a widespread opinion that the dysfunction has genetic roots. They state that this surprising lack of agreement is blocking the advance of research and the development of therapeutic approaches. In addition, there are serious shortcomings in the currently favored methodology of stuttering research: evidence-based medicine and practice have reduced the amount of high-grade evidence research data to such an extent that much useful information has been lost; the relevance of functional magnetic resonance imaging is controversial, and the hope that one day genetic engineering will correct stuttering-related mutations without severe side effects is unrealistic (Kollbrunner, *et.al*, 2014). In a nutshell, the intrinsic causes of stuttering by Hunt (1870) have no reviews regarding the deformity of the tongue. In order to address that, researchers tend to investigate in general the causes of stuttering and Kollbrunner, *et.al* (2014) like other authors agree that the disorder have a strong genetic influence without attributing it to the deformity of the tongue.

2 Extrinsic causes of stuttering

As for the extrinsic causes of stuttering, Hunt (1870) asserts that when the organs of speech are in a normal condition, but are impeded in their action by marked affections of the parts situated

outside the vocal and articulating apparatus, the causes are said to be extrinsic. Paralysis; spasms of the organs of speech, produced by local or general affections of the nervous system, general debility, intoxication, congestion, the cold stage of fever, loss of blood, narcotics and many more may be deranging the action of the various muscles, more or less, and tend to produce stuttering. Based on Hunt (1870), it may also be caused by defective hearing, weakness and suppression of the mental functions as in partial idiotcy or imbecility. These conditions when present in a high degree may even produce alalia or dumbness. The dyslalalia or rather faltering, of the aged chiefly arises from local or general debility. Sudden emotions, by affecting the brain, frequently cause a transient stammering. Children stammer or rather 'lall' partly from imperfect development of the organs of speech, and partly from want of control over them and also from deficiency of ideas and imitation.

3 Functional causes of stuttering

Hunt (1870) posits that functional stuttering may result from habit, imitation, or affections. This especially applies to slight defects such as rthotacism, lisping etc. Some scholars assert that these may be inherited in the shape of organic defects which are quite possible but in Hunt's (1870) opinion, they are in most such cases owing chiefly to imitation. This, according to him explains why the whole families are sometimes noticed as affected with a peculiar species of stammering. Paris (1803 (Hunt, 1870)) records a curious case of a whole family being unable to pronounce the palatine and guttural letters. He notes that the head of the family, his grandfather and his children with the exception of the youngest son were in this situation. The youngest son was an exception because he grew up in the different country with different people. This according to him was not necessarily hereditary but may have been the result of imitation and neglect. These

functional causes of stuttering are similar to the environment causes of stuttering as stated by Barlow and Durand (2005).

As a response to the view of Hunt (1870) on the causes of stuttering, the current literature does not focus on the defects of speech articulators but it does emphasise that the behavioural and physical symptoms can occur at the same time such as lip tremors, clenched fists, sudden head movement and rapid blinking (Eske, 2019). Dandurant (2019) in addressing the causes of stuttering notes that despite extensive research, the causes of stuttering remain largely unknown and she further notes that the singers are among the famous people who stutter.

In the meantime, causes of stuttering have been explained by various professionals in different ways. Psychiatrists suggest that the problem generally result out of a neurotic or a psychotic conflict (Ward, 2006). Psychologists infer that the cause may be due to an emotional conflict and an inability to respond adequately because of a neurosis. Speech pathologists on the other hand state that the problem is due to the attempt made by the child to speak in sentences before he is ready for such behavior. Other scientists, however, suggest that the outbreak of non-fluency is neurologically based and may be due to such cases as cerebral dominance, confusion, metabolic imbalance or delayed auditory feedback. There has been a limited number of individuals who have related the cause of the problem to one or more symptoms of stuttering such as a breathing problem or rapidity in speech (Ward, 2006).

According to Barlow and Durand (2005) stuttering is caused by genetic, neurological and environmental factors. Ward (2006) explains the environmental factor contributing to the cause of stuttering in that it is possible in some cases that a child who stutters maybe picking up language on a disfluent model in that stuttering can be imitative. He, however, notes that some

researchers have claimed that extra pressure such as telling a child how to respond using advanced language can lead to increased risk of stuttering. The genic factor means that stuttering runs in families noting that it is inherited (Frigerio-Domingues and Drayna, 2017). Graham (2014) adds that the identical twins of a person who stutter are more likely to stutter than non-identical twins. Stuttering often runs in families but not in a simple way and in contrast to the environmental cause of stuttering, it is suggested that studies on adopted children indicate that the environment does not have a big role in stuttering (Graham, ibid).

According to Jonas (1979) twins of both sexes seem to stutter more than other people. Among identical twins (who develop from a single fertilized egg), if one twins stutters, the other twin almost invariably does too. Among fraternal twins (who develop from two eggs and so do not share the same genetic makeup), there is a much better chance that one twin will stutter while the other will not. These all account to the fact that people stutter because of a genetically transmitted flaw which is a defect in the speech apparatus or a miswired circuit in the nervous system that reliably shows up in a certain subgroup of the population, like birthmarks or color blindness or male-pattern baldness.

Based on the functional causes of stuttering, Paris (1803) in Hunt (1870) records a curious case of a whole family being unable to pronounce the palatal and guttural letters. The head of the family, M. Crervo, apothecary to the hospital St Jaques, his grand-father and his children, with the exception of the youngest son, were in this condition. The latter was taken to Madrid in early infancy, and brought up there. This shows at all events that the defect was not necessarily hereditary, but may have been the result of imitation and neglect.

4 Biologic causes of stuttering

According to Ambrose (2004) there are four biological causes of stuttering: sensory, central processing, motor, and genetics.

The role of auditory function has long been discussed in the field of stuttering. In relation to the sensory side of the picture, stuttering tends to be reduced in noisy environments, and it may be reduced or even eliminated with delayed auditory feedback or while there is noise in one or both ears. This effect is even more curious in that when normally fluent speakers have delayed auditory feedback played, their speech tends to become disrupted. According to Shane (1955) quoted by Ambrose (2004), stuttering is reduced with high levels of binaurally applied noise. Shane (1955) in Ambrose (2004) concluded that when PWS (People With Stuttering) cannot hear themselves, speech anxiety is reduced and so is the stuttering. A decade later, Cherry and Sayers (1965) in Ambrose (2004) conducted a series of experiments using both air- and bone-conducted noise of different frequency ranges to identify which one of many possible combinations was the most effective in ameliorating stuttering. Based on their results, Cherry and Sayers theorise that PWS have abnormal auditory feedback. They think that the noise works because it neutralises the defective auditory feedback. Therefore, they conclude that stuttering is a perceptual problem. On the other hand, Wingate (1969) in Ambrose (ibid) suggests that noise reduces stuttering because it causes motoric alterations, such as changes in vocalisation.

According to Ambrose (ibid), in the 1930s, Travis (1931, 1978) expounded on a theory of the involvement of the brain in stuttering, claiming that stuttering resulted from incomplete cerebral dominance or, more precisely, from “general reduction in cortical lead control”. The brains of PWS have been under scrutiny continuously from that time. As technology has improved,

documentation of functional differences in brain activity in normally fluent speakers versus those who stutter has become available, although results were often conflicting and thus inconclusive. For example, Ambrose (2004) suggests that some EEG (Electroencephalogram- a test to evaluate the electrical activity in the brain), studies show abnormalities in hemispheric processing in stutterers in that they used the right hemisphere more than normally fluent speakers did (Fitch & Batson, 1989; Moore & Haynes, 1980); other studies however had negative results (Pinsky & McAdam, 1980). Age of participants and stimuli varied from study to study, which may explain the conflicting findings. A better explanation may be that PWS are a heterogeneous group and not knowing how to group them leads to very inconclusive findings.

Another area within the purview of central processing is the involvement of language in stuttering (Ambrose, ibid). He further notes that there have been investigations of phonology, syntax, semantics, and cognitive processing. It has been noted that not knowing how to subgroup stutterers leads to very inconclusive findings. There seems to be a higher incidence of the co-occurrence of stuttering and phonological disorders, which led to speculations about a mechanism explaining both. Postma and Kolk (1993) introduced the covert repair hypothesis, which explains not just stuttering, but all types of dysfluencies, as self-repairs. Ambrose (2004) notes that monitoring and error detection can occur at the pre-articulatory level. Dysfluencies are seen as by-products of covert repairs of internal speech errors, at the level of phonological encoding. When correction is successful, no error appears, but it may impede progress of an utterance, thereby leading to disfluency. Normal speakers perform covert repairs of phonological encoding. Therefore, PWS may have a deficit in phonological encoding, leading to more frequent phonological encoding errors, which must frequently be repaired, which leads to stuttering. More recent work has argued this theory (Yaruss & Conture, 1996). Other work has

been directed toward linguistic complexity. As mean length of unit (MLU) and syntactic complexity increase, stuttering is more frequent (Sawyer, 2008; Yaruss, 1999). It has also been shown that adults who stutter may have more difficulty producing unfamiliar vocabulary fluently (Hubbard & Prins, 1994).

With regards to motor planning and execution, Zimmermann (1980) conducted articulatory dynamics experiments to explore if stuttering could be due to motoric deficit. In the speech of adults who stutter, he described slower and asynchronous movements in their fluent speech, and aberrant positioning of articulators during stuttered speech. Zimmermann (1980) concludes that stuttering is a disorder of movement, and explains that as people speak, there is a temporal and/or spatial range of movement that is tolerable to the system. As long as the speaker remains within that range, there is no fluency breakdown. If, however, the range is exceeded, due to emotional, perceptual, and/or physiological events, the system is thrown off balance with conflicting signals to and from the brain at a reflex level, leading to oscillations (repetitions) and fixations (blocks and prolongations).

Mixed through some of the literature on physiologic and biologic aspects of PWS and stuttering are references to genetics (Ambrose, 2004). Bryngelson and Rutherford (1937) in Ambrose (ibid) report that the incidence of stuttering amongst relatives of stuttering probands higher than in the families that do not have stutterers. Early studies according to Ambrose (ibid) focused on family incidence and personal characteristics, such as handedness, of PWS (Bryngelson & Rutherford, 1937). From the 1930s to 1990s, a number of stuttering researches have been conducted on genetics (Ambrose, ibid). Ambrose, Nancy and Yairi (1997) focused on possible subtypes of stuttering and performed separate segregation analyses for the families of children who

recovered from stuttering (excluding persistent stuttering relatives) and the families of children who persisted in stuttering (excluding recovered stuttering relatives).

Both analyses yielded the single highest likelihood for the presence of a major gene component Single Major Locus (SML) in addition to Multi-factorial Polygenic (MFP) contributions. Two additional findings were remarkable. First, the parameters for the SML were almost identical in each analysis, indicating that this component involves (at least) one major gene that is present in both forms of stuttering, persistent and recovered. But, for the MFP parameters, the heritability component (phenotypic variation attributed to a polygenic, additive effect) differed. Thus, Ambrose *et.al* (1997) study advances knowledge about the role of genetics a step further. The results show that not only does the initial expression of stuttering has strong genetic components, but also that its developmental cause is influenced by genetics. Specifically, Ambrose *et.al* (ibid) indicate that other authors show that children who stutter and who have a familial history of chronic stuttering would tend to follow that same pattern. Similarly, children who stutter but have a familial tendency of recovered stuttering would tend to follow that pattern.

Hategan, Maria and Lacramioara (2012) conducted a study on the psychological approach of stuttering paradigm mainly on deliminating several specific particularities in stuttering pathology. They used a structural approach: phonetic aspects, phonological aspects, morpho-lexical aspects, syntactic aspects and pragmatic aspects. Their hypotheses were that degree of familiarities with the explored linguistic material influences, dysfluencies loci and frequency; linguistic complexity (both phonetic; phonological, lexical and morpho-syntactic point of view) increase dysfluencies number; and dysfluencies in oral language are also transferred to written language (while writing). The methodological design used was a case study. Their conclusions were that the research proved the fact that stuttering pathology from a psycholinguistic point of

view is dependent on each language peculiarities. They advocated for a cross-linguistic and cross-cultural study in order to identify the recurrent aspects; otherwise all researchers must be analysed and interpreted within the limited boundaries of the country where people speak the language in which the experimental approach was developed. This study suggests an alternative methodology (the use of case studies for singing and speaking) and based on the conclusion by Hategan *et.al* (2012), the breathing rates to be assessed will be analysed depending on each participant; then followed by a general analysis.

2.3 Characteristics and effects of stuttering

According to Buchel and Sommer (2018), stuttering is a disruption in the fluency verbal expression characterised by involuntary, audible or silent repetitions or prolongations of sounds or syllables. The authors go on to say that these are not readily controllable and may be accompanied by other movements and emotions of negative nature such as fear, embarrassment, or irritation.

Field (2004) lists the following as symptoms of stuttering:

- The rapid blinking of the eye;
- Tremor of the lips;
- Blocking of the airflow;
- Difficulty of speech; and
- Running out of breathe while talking or out of the context one stops talking.

Mayo (2017) on the other hand lists the following as symptoms of stuttering:

- Difficulty starting a word, phrase or sentence;

- Anxiety about talking;
- Facial tics;
- Head jerks;
- Clenching of the fists; and
- The limited ability to effectively communicate.

Field (2004) states that sufferers may use fillers such as *erm* or *oh* to indicate the gap and that one of the symptoms of stuttering is the blocking of the airflow because the mouth would be opened to say something but no words would be uttered. He goes on to state that the blocking of the airflow is the most common characteristic on stutterers because it results in long pauses and effortful speech and distorted facial expressions. The uses of interjections such as *mmm* or *aah* are also signs of stuttering and the words are also left incomplete because of irregularities of rhythm and intonation (ASLHA- American Speech Language-Hearing Association, 2014). Stress and being put on the spot to speak can make the symptoms worse (ASLHA, ibid).

Boyle, Blood and Blood (2009) reveal through a survey that most PWS say that they prefer not to talk at all rather than allowing others to hear that they stutter. This data suggests that those who stutter are self-conscious regarding their stuttering behavior and may have decreased self-esteem, even if they are not obvious (Hunsaker, 2011).

According to Boyle et al. (ibid), many people who stammer (PWS) also believe that prejudice about the condition has made it difficult for them to find employment, to be promoted, or to achieve their career potential. Some even turned down jobs or promotions because of fears that their stammer might prevent them from carrying out their role effectively.

This is not surprising; stuttering can interfere with a person's ability to communicate effectively, which may lead to poorer performance in school activities that require speaking aloud (McAllister, 2013). Some children who stutter may be reluctant to ask questions in class if they do not understand something, which could lead to poorer academic performance. Stuttering is also associated with negative peer responses including bullying, which makes school an unpleasant experience and can result in avoidance of speaking situations. Continuing to use avoidance as a coping strategy into adulthood could lead people to miss out on employment opportunities in just the way that interview respondents reported. Furthermore, if the negative prejudices of non-stuttering children are not challenged or corrected, they might be carried into adulthood, which could well give rise to the kind of employment discrimination that some PWS report (McAllister, 2013).

Psychosocially, stuttering is a multifaceted disorder that can have a significant impact on people who stutter, one that extends beyond the actual communication difficulties these individuals encounter. Social, emotional, and psychological issues can accompany stuttering, largely as a result of society's depictions of and reactions to those who stutter (www.asha.org (n.d.).

According to Hunsaker (2011), Shears (1969) conducted a survey asking whether or not fluent individuals felt that those who stutter at a severe level would be acceptable marriage partners. Alarmingly, only 7% of participants felt that PWS severely would be acceptable for marriage. This evidence suggesting stuttering as a negative attribute when seeking romantic relationships is further supported by data collected in 1990 by Boberg. A qualitative study conducted on wives of men who stutter reported that over half of the wives stated they did not notice their partner's stuttering during the first time that they met (Boberg, 1990) in Hunsaker (ibid). It was further noted that two-thirds of the social events that those who stutter partook in were found to be dates

as couples rather than in a group setting (Linn, 1998). It is likely that group dates resulted in fewer opportunities to speak and a more casual environment which are factors which aid fluency (Guitar, 2006). Although it is clear that stuttering is perceived as an undesirable feature in a romantic partner, there seems to be ways to mitigate problems. Linn (1998) described a study conducted by Collins and Blood in 1990 to document the effect of disclosure in the early stages of a romantic relationship. Two males who stuttered severely and two males who stuttered mildly went on dates with females. One member of each group disclosed to the female they were seeing that they have a challenge with stuttering. The females were interviewed at the end of the dates and it was found that, regardless of severity level, individuals who disclosed their stuttering were perceived as more intelligent, good-looking, and having a better personality (Linn, 1998; Hunsaker, 2011).

During adolescence and young adulthood most individuals seek opportunities for employment or higher education, often both. Most jobs require potential employees to fill out a job application, which should not be a challenge for a PWS. It is the next step, the interviewing process, which presents a challenge for a PWS (Parry, 2009). A job interview is usually a situation which involves some anxiety, which could make an individual stutter more severely than he or she normally would. Most college and training programs also present challenges for a PWS. Many classes require students to deliver speeches and oral presentations. Both are situations which are also likely to impact speech fluency of a person that already has challenges with stuttering (Parry, 2009; Hunsaker, 2011).

2.4 Types of stuttering

Nall (2012) has identified three types of stuttering, namely: developmental, psychogenic and neurogenic stuttering. Psychogenic and neurogenic stuttering are however considered as one since they involve acquired dysfluency.

1 Developmental stuttering

Developmental stuttering is the most common type of stuttering. Sometimes called idiopathic stuttering, it refers to stuttering that arises in childhood usually pre-school years for multi-factorial reasons (Ward, 2006). It is the most common in children younger than five years of age as they develop their speech and language abilities, and it usually resolves without treatment. Nall (2012) adds that developmental stuttering is more common in males than females. Developmental stuttering evolves before puberty, usually between 2-5years without apparent brain damage or other known cause. Some children are developmental stutterers and the disorder resolves as they grow up. Some people are lifelong stutterers which Buchel and Sommer (2018) refer to as persistent developmental stuttering (PDS).

Persistent developmental stuttering is a very frequent disorder, with approximately 1% of the population suffering from this condition (Buchel and Sommer, 2018). An estimated 3 million people in the US and 55 million people worldwide stutter. Prevalence is similar in all social classes. In many cases, stuttering severely impairs communication, with devastating socioeconomic consequences. The incidence of persistent developmental stuttering is about 5% and its recovery rate is up to about 80%, resulting in a prevalence of persistent developmental stuttering in about 1% of the population. Buchel and Sommer (ibid) stipulate that recovery is considerably more frequent in girls than in boys, and thus the male-to-female ration increases

during childhood and adolescence to reach 3 or 4 males to every one female in adulthood. The severity of PDS is clearly modulated by arousal, nervousness, and other factors (Andrews et al. 1983) in Buchel and Sommer (ibid). This has led to a two-factor model of PDS. The first factor according to Buchel and Sommer (ibid) is believed to cause the disorder and is most likely a structural or functional central nervous system (CNS) abnormality, whereas the second factor reinforces the first one, especially through avoidance learning.

Buchel and Sommer (ibid) go on to say that the clinical representation of developmental stuttering differs from acquired stuttering in that it is particularly prominent at the beginning of a word, phrase in long or meaningful words or syntactically complex utterances and the associated anxiety and secondary symptoms are more pronounced. When using speech waveforms and sound spectrograms, the repeated readings of stuttering frequency tends to decline (adaptation) and to occur at the same syllables as before (consistency).

2 Neurogenic/ psychogenic stuttering

Acquired dysfluency can be classified as neurogenic or psychogenic stuttering (Almada, Casquinha, Constante, Heitor and Simoes, 2016). Psychogenic stuttering originates in the part of the brain that governs thinking and reasoning (Nall, 2012). It starts abruptly after traumatic events and maybe experienced even after puberty. It is acquired after stroke, trauma or brain injury. This happens when one has not had stuttering since birth, but acquired after stroke, trauma or brain injury (United States Department of Health and Human Services, 2012). Neurogenic or acquired stuttering occurs after a definable brain damage such as stroke, intracerebral, hemorrhage, head trauma. According to Buchel and Sommer (2018), it is a rare phenomenon that has been observed after lesions in a variety of brain areas. It is important to

note that everybody has moments of disfluency where the more normal ones include repeating a word, and repeating part of a sentence. The National Institute on Deafness and other Communication Disorders (NIDCD) (2017) note that all stuttering was believed to be psychogenic, caused by emotional trauma, but today researchers know that psychogenic stuttering is rare.

Ludlow, Rosenburg, Salazar, Grafman and Smutok (1987) state that acquired stuttering is different from uncontrolled rapid festinating syllable repetitions that occur during palilalia speaking: a speech disorder characterised by involuntary repetitions of syllables words and phrases. Rather, acquired stuttering involves repetitions, vowel prolongations and occasional blocks (Ludlow *et al*., 1987). However, Borsel and Tailliea (2001) believe that the symptoms of stuttering cannot easily differentiate acquired stuttering from developmental stuttering.

2.5 Singing anatomy

According to Lander (2010: 1) naturally, 'the voice is physiologically wired to respond to and communicate one's thoughts and feelings in real time'. The thoughts and feelings are what make the voice go and the musical instruments are often described as comprising:

- A generator - something to power the sound
- A vibrator - the thing that actually makes the sound
- And a resonator - a means of amplifying the sound

According to New Mexico State University (n.d.) no matter the type of song and vocalisation all songs include:

- The nose which warms and moisten the air and the nasal cavities involved in the resonance of tones.
- The oral cavity that comprise of the lips, teeth and tongue that serve as the articulators.
- The pharynx and the oral cavity which both acts as resonators that selectively amplifies to varying degrees of intensity, fundamental tones and over tones.
- The larynx an organ consisting of a cartilaginous framework containing muscles and joints. The vibratile part of the larynx is the vocal folds which are the producers of sound.
- The lungs that supply a stream of air which passes through the trachea.
- The vocal folds which vibrate throwing the stream of air into a series of complex vibrations.

In addition to the articulators above, web.nmsu.edu (n.d.) insists that the breath control is the most basic step in singing, and learning how to control one's breath can be beneficial to the singer. The current study is mainly concerned with the breathing rate and pattern which are hypothesised to have an impact on the way stutterers speak. It is believed by the current researcher that knowing how much air is used for stutterers and non-stutterers in speech production can perhaps help the stutterers to control their breaths and maybe decrease the stuttering issue. Concerning the stutterers, Dandurant (2019) claims that singers are amongst the famous people who stutter, for example, Ed Sheeran.

Hear (1979) conducted a study on factors that contribute to the reduction of stuttering during singing. He wanted to see whether the reduction of stuttering typically observed during singing

was associated with altered vocalisation or the familiarity of the melody. In his study he had eight subjects. Before test, each subject demonstrated that they knew the melody and lyrics of a well-known song from memory. The subjects were allowed to read the lyrics aloud and then to sing them. Later, the subjects had to read and then sing a set of unfamiliar lyrics to the conventional melody of the same song. All performances during these activities were audio-recorded. The findings of this study showed that subject's duration of dependent measures of utterance and stuttering frequency were definitely longer during singing than reading. These findings were interpreted to mean that changes in vocalisation cannot account for all the decrease in stuttering that occurs during singing. Dahm (2012: 2) adds that there is reduction of stuttering when singing, and that he has seen stutterers stuttering during singing, '…of the thousands of people who I have either evaluated or treated, a handful has stuttered occasionally when singing particularly when starting to sing'. Unlike Hear (1979), the present study will evaluate males and females, stutterers and non-stutterers to see if there is the difference in the breathing rates during sing and speaking. Just like Hear (1979), the present study will also audio-tape the two activities for further analysis.

Glover, Kalinowski, Rastatter and Stuart (2002) conducted a study on the effects of instruction to sing on stuttering frequency at normal and fast rates. They suggested that singing as a fluency enhancing mechanism is well established. In their study, twelve stutterers were instructed to read or sing each of the four passages at normal and fast rates. The study showed that participants displayed a 75% reduction in disfluency in the singing condition relative to the reading condition. Fluency was maintained in both the normal and fast rates of production. This study further proves Hear (1979) and Dahm (2002) that there is reduction of stuttering during singing. However, all the three studies fail to show any leading factor to this observation.

2.6 Breathing physiology

Lees and Soni (2014) recommend that breathing is carefully controlled by the central nervous system. The brainstem contains a respiratory centre producing spontaneous rhythmic, automatic breathing activity. This is regulated by a multitude of connections from higher centres and the periphery including chemoreceptors and reflexes within and outside the lungs and airways. It may be overridden voluntarily or involuntarily and to facilitate activities such as speech, swallowing and coughing. Impulses are sent via motor neurons to the effectors, the respiratory muscles and health. This integration allows close control of partial pressure of oxygen (PO2) and partial pressure of carbon-dioxide (PCO2) and pH.

Lee and Soni (2014) add that the respiratory centre consists of several distinct groups of neurons within the medulla: the dorsal group, located near the nucleus tractus solitarius associated mainly with timing and control of inspiration and the veutral group in the veutrolateral medulla, comprising four nuclei with inspiratory, expiratory and laryngeal and pharyngeal dilator functions. The automatic pattern of respiration is generated from the dorsal group of neuron and other adjacent groups within the medulla. The inspiratory muscles signal transmitted to the respiratory muscles and airway dilators builds up like a ramp and ceases; allowing steady ventilation and preventing gasps. Expiration is passive during quiet breathing resulting from elastic recoil of the lungs and chest wall and most expiratory neurons are quiet but become active at times when minute volume is increased.

2.7 Linguistic aspects of stuttering

According to Gero (2012) stutterers tend to struggle with words beginning with consonants rather than vowels, longer words, content words, low frequency words in English language,

words at the beginning of a sentence, words in the sentence that has more stress, the first sound or the syllable or the accented syllable and that young children stutter more frequently on function, not content words. On the other side, Schafer (2008) conducted a study where he was assessing the characteristics of stutterers for German-English bilingual speakers and his findings were that adults who stutter struggle with word class, word length, sentence position, phone a word starts with, linguistic stress and that stuttering occurred more frequently on content words than function words, longer words than shorter words, words beginning with consonants opposed to words beginning with vowels.

The child who is predisposed to stutter and is trying to use newly acquired language constituents or trying to communicate complex ideas he may be more likely to stutter. Thus under these conditions he may be overloading his speech and language capacity (Gero, 2012). In addition, Bloodstein (1987) in Louko, Edwards and Conture (1999) hypothesises that a child who has difficulty with articulation or language will start to believe that speaking is difficult and the anticipation of difficulty leads to hesitation and struggle and later to stuttering. Van Riper (1973) in Gero (2012) suggests that "Stuttering usually begins at the very time that the great advances in sentence construction are over, and it seems tenable that, when the speech models provided by the parents or the siblings of the child are too difficult for him to follow, some faltering may ensue".

Louko *et.al* (ibid) indicates that between 75 % of people who stutter also exhibit articulation difficulties. Mackay and McDonald (1984) hypothesise that stuttering on the earlier speech segments would be differentially affected by the later phonetic characteristics. Repetition errors are common among stutterers and non- stutterers but prolongations and blocks were found only

in stuttered speech. The ***Covert repair hypothesis*** is based on the notion that difficulties with phonological encoding, the ability to retrieve or construct phonetic plan, may be related to instances of stuttering. Thus , according to this theory , people who stutter are assumed to have slower than –normal phonological encoding processes, which increases the chances that there will be a miss selection of intended phonemes, resulting in more potential errors. Subsequently, covert repair of these potential errors, before they become speech language output, is thought to disrupt overt speech language production, resulting in stuttering. Furthermore, Lou Ko (1999) asserts that, if the speaker speeds up his or her speech language output, chances of phoneme miss selection increases even more and thus potential errors increases. In other words, the speech production system is operating beyond the temporal capacity of phonological encoding system.

Ronsons (1976) indicates that low frequency words are stuttered more than high frequency words. The explanation for this is that perhaps the low frequency words involve more complex motor planning. A study done by Foundas, Cindass, Mock and Corey (2013) investigated the relationship between word frequency level and stuttering within the context of four selected sentence types. Fifteen stuttering children aged 8-12, read 48 sentences of four different transformational types and three word frequency levels 12 simple active- affirmative-declaratives (SAAD)12 negative , 12 passive and 12 negative passive. All sentences were identical in terms of underlying swings and variations of the SAAD sentences. Results agreed with Ronsons study with adults 1976 in that when the group rating was severe and the sentence type was negative, stuttering increased significantly as word frequency level increased. It appears that the children's stuttering in relationships to word frequency level is a different response that is subject to

variables of sentence types and severity rating of stuttering. The greater the frequency of occurrences of a word, the lesser the percentage of stuttering.

Anderson and Conture (2000) suggest that in pre-school, stutterers score lower marks in vocabulary than in language in general. Also some children with stuttering show higher vocabulary scores than language scores. Clinically, this implies that there should be protracted forms of treatment containing a strong component of language enrichment, stimulation and treatment along with dysfluency modification (Hall and Jerger, 1978; Boscolo, Rescoria and Ratner, 2002).

The position of a word within a sentence, phrase, and utterance has been found to be important in determining the probability of stuttering. The position of a sound in a word is of major importance in determining whether or not stuttering will occur on it or it. Many studies in literature have revealed the relationship between the word position in a sentence and stuttering. All investigators have found that more stuttering occurs on initial sound than on later sounds or syllables. When stuttering does occur later in a word, it is usually on the syllable having the primary or the secondary accent. Bloodstein and Gantwerk (1967) stress that in child‘s utterance, the position of the stuttered word is more important in determining stuttering than their grammatical classes. They also support the fact that stuttering reduces as the position of the word moves further from initial position. From this study, it is therefore clear that there is a relationship between the position of the word in a sentence and stuttering. Bloodstein (1974) tried to explain the loci of stuttering primarily in terms of word position, he found that earliest stuttering occur at the beginning of sentences and major syntactic units. As the stutterers grow old stuttering is found at the beginning of word within the syntactic units.

2.8 Cures and therapies of stuttering

According to Jonas (1979), the stuttering issue was treated based on the theories surrounding it. Aristotle believed that people stutter because they had abnormally thick hard tongues and the solution to that was blistering substances to drain away the black bile that was believed to cause the problem. Then Roman physician Celsus on the other hand suggested gargling and massages to strengthen a weak tongue. Prussian the surgeon believed that people stutter because they had too large tongues and his solution was cutting chunks from the sides of the tongues. The remedy for the contagious theory of stuttering was weed off all stutterers out of your child's circle of playmates (Jonas 1979). In the 19th century, it was believed that stuttering is caused by a nervous condition and since the nervous system was beyond medical science, therapeutic attention was focused on the stutterer's outward symptoms especially abnormal breathing and faulty coordination of the speech organs.

Hunt (1870) proposes that treating numerous defects such as stuttering should be treated in relation to the following groups:

- Those arising from or associated with organic or functional disorders of the brain or nervous system
- Those arising from organic or functional defects of the buccal or nasal cavities
- Those which are the direct result of habit, imitation or affectation.

The recent work of Ward (2006) suggests that once stuttering has persisted into adulthood, there is no known cure. Therapy techniques include increasing awareness about speech production, about patterns of stuttering-teaching breath support strategies, teaching tension reduction strategies, as well as counseling and self-advocacy (Ward, ibid).

Quesal and Yaruss (2017) propose the historical treatment that Dean Williams developed in the 1950s. The point of view that Williams talked about was based on the idea that people who stutter need to move away from animism or the mind-body separation that causes them to view stuttering as some kind of separate entity within themselves. Williams (1950) quoted by Quesal and Yaruss (2017), suggest that many people who stutter come to believe that stuttering is inherently part of them just as some individuals who consider themselves as inherently shy. Once a label such as shy is applied, they will say I am unable to meet new people because I am shy and when asked about how they knew that they are shy they will say they were told so. In a similar way, people who stutter might say 'I am unable to talk differently because I am a stutterer' (Williams, 1990). Quesal and Yaruss (ibid) note that Williams believes that people who stutter may rely on their feelings to determine when stuttering is about to occur and when these feelings arise, they do things that interfere with their speech and these actions ultimately become the stuttering behaviors themselves, Williams (ibid) contention according to Quesal and Yaruss (ibis) was that people who stutter fail to see the relationship between what they are doing and what they feel is happening to them. According to Quesal and Yaruss (ibid) this idea is similar to that proposed by Van Riper (1982) and Johnson (1961). The implications of William's point of view were based on his approach of Forward Moving Speech which was based on the following principles:

- Most of the time people who stutter speak fluently. Clinicians should help their clients identify those things they do when they speak fluently and those that they do when they stutter, focus more on speaking fluently than on not stuttering.
- When speakers are disfluent, they do something to interfere with their ability to speak.

- Speakers can modify those interfering behaviors in order to speak more effectively.
- People who stutter need to become the world's foremost experts on how they talk. Clients need to understand that talking is a complex process so changes in speech are likely to take some time.
- The ultimate goal of therapy is not necessarily perfectly fluent speech but the goal is for people who stutter to become the most effective speakers they are capable of becoming.

These above principles proposed by Williams (1950s) are the philosophical treatment of stuttering and the parameters for Forward Moving Speech are listed below which are the basic things a speaker must do in order for speech to flow more smoothly. According to Quesal and Yaruss (2017), Williams (ibid) began therapy with what amounts to a short course in speech physiology. Specifically, people who stutter need to understand that speaking involves respiration, phonation, and articulation and that people rely on various types of feedback as they talk. The authors note that Williams (ibid) emphasises that interference in one of the parameters will lead to disfluent speech:

a) Airflow

It is necessary to have air flowing from the lungs in order to speak. Respiration provides the energy for driving force for speech. There are differences between the way we breathe for life purposes and for speech purposes. Muscular control differs for long and short utterances. Relaxation pressure affects the amount of muscular effort that is necessary for speech. It is important for therapists to teach their clients about respiration in order to help them become more aware of events occurring at the level of the rib cage and abdomen, and more aware of how much air is in the lungs at any given time while they speak.

b) Movement

Speaking is a process of moving various articulators and other physiological subsystems to create specific linguistically relevant sounds. Without movement, we cannot speak, because articulation and other physiological events involve movement of various substructures to create gestures and sounds needed for speech. In order to understand the importance of movement for speaking better, clients need to develop a better awareness of the movement during fluent speech. Clients should remember that movement occurs at a number of levels not only the lips, jaws, tongue but also the ribcage and abdomen as well.

c) Timing (rate)

It refers to the temporal characteristics of one speech structure but also to the timing relationships among multiple structures during speech. Timing of specific events related to the production of speech is particularly important. If there is a lack of coordination between and among the various speech structures and levels of the speech chain the output will be affected negatively. The result of mistiming can range from the production of incorrect sounds to a complete breakdown in the production of speech. For instance, if the release of constriction for a stop consonant precedes onset of voicing by a long time, the result is that a voiced sound will be produced as a voiceless sound /pab/ for /bab/. Precise timing is also important for the activation of muscles needed to achieve the intricate relationship between the movements of various articulators. If two muscles that are supposed to be activated in series are actually activated in parallel, then a disruption in speech is likely to occur. Timing relates to the speaking rate because when people slow their speaking rate, it often leads to considerable change in the timing of speech movements.

d) Sound (voicing)

There should be some type of sound in order to produce speech because speech is just a series of sound. In fact, speech can be described as a series of hisses, pops and buzzes. Williams differentiated sound from voicing because not all sounds are voiced. Many people who stutter report that they experience difficulty initiating or maintaining voicing or transitioning from voiceless to voiced sounds. If speakers understand that speech consists of a series of voiced and voiceless sounds, they can explore the role that voicing onsets and offsets may play in their stuttering.

e) Tensing

Tensing refers to the necessary appropriate increase in physical tension required for moving articulators. Examples include tensing of the vocal folds or jaw muscles associated with the production of speech sounds transition from one speech sound to the other. Because many clients come to think that there is a direct relationship between their speech behavior and their emotions, it is important to note that this parameter does not refer to the emotional state of tension. Tensing refers to the muscular effort or pressure whereas tension refers to an uncomfortable emotional state. Williams maintained that people who stutter can speak effectively even in the face of heightened emotion once they understand that it is their reaction to their emotions that often leads them to do things that interfere with their speech. During speech, individuals must exert the proper amount of muscular effort. Many people who stutter, however, use excess muscular effort during speech due in part to their emotional reactions resulting from their negative experiences associated with stuttering.

The National Institute of Deafness and other Communication Disorders (NIDCD) (2017) suggests that the current therapies for teens and adults who stutter focus on helping them learn

ways to minimise stuttering when they speak, such as by speaking more slowly, regulating their breathing, or gradually progressing from single-syllable responses to longer words and more complex sentences. Most of these therapies also help address the anxiety a person who stutters may feel in certain speaking situations.

According to the NIDCD (2017) the U.S. Food and Drug Administration has not approved any drug for the treatment of stuttering. However, some drugs that are approved to treat other health problems such as epilepsy, anxiety, or depression have been used to treat stuttering though these drugs often have side effects that make them difficult to use over a long period of time.

The NIDCD (ibid) suggests that some people who stutter use electronic devices to help control fluency. For example, one type of device fits into the ear canal, much like a hearing aid, and digitally replays a slightly altered version of the wearer's voice into the ear so that it sounds as if he or she is speaking in unison with another person. In some people, electronic devices may help improve fluency in a relatively short period of time. Additional research is needed to determine how long such effects may last and whether people are able to easily use and benefit from these devices in real-world situations. For these reasons, researchers are continuing to study the long-term effectiveness of these devices.

2.9 Theories of stuttering

There are many theories about stuttering and some commentators have unkindly suggested that there are as many theories as there are researchers. According to Ward (2006) and Schaefer (2008) the theories of stuttering can eventually be distilled into three categories:

a) Those that relate to the stuttering moment itself

b) Those attempting to explain the etiology of stuttering

c) Those attempting to find new frames of reference from which to examine the disorder

The problem of stuttering has received much attention in the world of verbal communication yet no single theory has been propounded to explain the etiology of its occurrence (Ward, 2006). This continues to be a riddle because the etiological ambiguity of stuttering is similar to many problems in the field of mental health, medicine and social science in which genetic, environmental, psychological and social factors are all relevant but causes and effects are difficult to disentangle (Ward, 2006). Although none of the theories have ever satisfied the criteria of adequacy, various attempts have been made to summarise the theories in a variety of ways (Ward, 2006). Some of the theories of stuttering are mentioned below.

Cerebral dominance theory

An early explanation of stuttering was given by one of the first American Speech Pathologist, Travis (1931) in Ward (ibid). This explanation caught the attention of many, including the non-speech specialists, and was termed the cerebral dominance theory. The two hemispheres of the brain behave somewhat differently from each other. The left hemisphere dominates in speech and motor functioning because most of the anatomy of the speech system is approximately along the middle lines. One side of this neurologic system is the leader. The cerebral dominance theory suggests that in stutterers neither hemisphere of the brain takes the lead. The effect is that the muscles receive somewhat conflicting input, and the result is fragmented speech. The person develops unfortunate tactics both physiologic and psychologic to handle this neurologic conflict and stuttering develops (Ham, 1986).

This theory is limited to the present research in that; there is no proper equipment to enable brain scans during singing and speaking like the two activities in current study suggests. Even if the questionnaires included a section such as asking if the stutterers are right or left handed, a follow-up question like, 'Which ear do you use for the phone calls, left or right?'; still, the answer would have not been enough despite the knowledge that the brain is contra-lateral, a follow-up like brain scan would still be required for further evidence.

Biochemical theory

Biochemical theory was brought out by West in 1958. According to this theory, the source of stuttering is to be found in a basic difference between stutterers and non-stutterers in metabolic factors and tissue chemistry. The speech interruptions are triggered by social and emotional pressures, but the stutterer's neurophysiological mechanism for speech is rendered vulnerable to the disruptive effects of such pressures by a biochemical imbalance. West formulated the concept of stuttering as a convulsive disorder related to epilepsy and particularly akin to an epileptic-form disorder of childhood known as pyknolepsy (West, 1958). West (1958) claims that the stutterer is a basically seizure-prone person in whom outright convulsions are held in check by 5 numbers of observations purporting to show an elevated blood sugar in stutterers, a high incidence of stuttering among epileptics, and a rareness of stuttering among diabetics.

The present study adopts the principle which states that, 'the source of stuttering is to be found in a basic difference between stutterers and non-stutterers in metabolic factors and tissue chemistry'. The section of questionnaire that is concerned with the environment that increase or decrease stuttering is meant to identify the social and emotional pressures that trigger stuttering. However, in relation to the present study, the biochemical theory is limited in that the difference

between metabolic factors and tissue chemistry of stutterers and non-stutterers were not tested. Therefore, for the present study, the biochemical theory is employed only to identify the environments that trigger stuttering more.

Auditory monitoring theory

The variations of auditory monitoring theory approach are several but essentially it suggests that stutterers hear themselves as they talk. Hearing oneself is auditory feedback. Generally, the child learns and the adult continues to use auditory feedback to check speech output against what he intended to say. The stutterer, according to this idea, has self-hearing that is out-of phase or delayed from motor functioning. There is some conflict between input and output. This kind of conflict can result in hesitation, repetition or other stuttering-like behavior. This theory in relation to the current study, will help to address research three that seeks to identify the environment that make stutterers to stutter more or less. If the stutterers can anticipate that they are going to stutter or not in a specific environment, then this theory will have been employed in relation to the self-hearing.

Despite the theories suggested by Ward (2006), Jonas (1979) state that, a child stutters because he is over aware of the need to use the correct word, the correct accent and so on. Proponents of this theory such as Jonas (1979) cite the curious fact that several American Indian tribes in the Midwest among them the Utes and the Bannocks have virtually no stuttering problem. It happens that these tribes also have a remarkably permissive attitude towards children's speech. By contrast, their distant cousins in the Pacific Northwest, the Cowichans, expect children to take part at an early age in complicated rituals under the critical eyes and ears of the tribal elders. The Cowichans, who place a premium on verbal skills, have a highly competitive society and a high

incidence of stuttering. The reason why the children of the Utes and Bannocks do not stutter might be because no one ever tries to make them speak correctly. But the theory fails to explain why in so many other cultures some children of nagging parents turn into stutterers while others do not (Jonas, 1979).

In the nineteenth century, the theory that stuttering was contagious was vogue in the sense that one child would begin to stutter in conscious imitation of another and soon find himself unable to stop (Jonas, 1979). However, according to the behaviorism and learning theory, the idea that stuttering is a learned behavior or a 'bad habit' is quite old (Ambrose, 2004). Bloodstein (1995) in Ambrose (2004) provided an excellent overview of theories of stuttering that covers behaviorism and learning. Any discussion of behaviorism and learning theory in relation to stuttering must mention Wendell Johnson's diagnosogenic theory (Ambrose, 2004), stating that stuttering begins in the ears of the parents when they overreact to their child's normal dysfluencies. The child attempts to avoid the dysfluencies and, in the struggle, stuttering develops.

Along similar lines, Wischner (1950) in Ambrose (2004) portrayed stuttering as emerging in accordance with a more formal learning theory. Stuttering originates from a painful, anxiety-producing stimulation in the form of parental disapproval of normal dysfluency. In other words, the child anticipates negative, painful reactions to his or her stuttering and so tries to avoid them. Initial successful avoidance reduces the anxiety drive and thus reinforces the behavior that eventually becomes more complicated stuttering. Another concept is that stuttering results from an approach–avoidance drive (Sheehan, 1953 in Ambrose, 2004). In this concept, the desire to communicate collides with the drive to avoid speech anxiety, which may have roots in either or both personality and conditioning from prior negative experiences with stuttering. Bloodstein's

(1958) notion that stuttering is an anticipatory struggle arising from the belief that speech is difficult contains some similar elements (Ambrose, 2004). Stuttering is seen as a reflection of tension and fragmentation in speech when the complexity of the act causes concern and feelings of being overwhelmed. Still another view explains stuttering as a behavior that is acquired through operant conditioning, that is, a behavior that is shaped by its own consequences (Ambrose, 2004).

The fact that stutterers hear themselves can be used as a self-therapy for them. This theory, in relation to the present study, will help the stutterers in that, once they are aware of the sounds and words that make them stutter, they can substitute them, pause or take a deep breath before uttering them. Therefore, this can indeed be used as a self-therapy for them, and they can prepare themselves before uttering such words or sounds.

2.10 Theories of speech production

Speech sounds are produced through a series of precisely coordinated muscle movements involving breathing, phonation (voice production), and articulation (movement of the throat, palate, tongue, and lips) (NIDCD, 2017). Muscle movements are controlled by the brain and monitored through our senses of hearing and touch (NIDCD, 2017). According to Abel and Babel (2017), several theorists have used evidence from errors to construct theories of speech production and there are some assumptions regarding speech production:

(i) it is assumed that there is a substantial amount of pre-production planning of speech

(ii) most theorists assume that there is a series of processing in four stages

(iii) it is assumed that the processes proceed from the general (semantic) to the to the specific (the units of sounds to be uttered).

However, the speech production occurs at four levels; semantic level, syntactic level, morphological level and phonological level (Dell and O'Seaghdha, 1991 in Abel and Babel, 2017). According to the spread-activation theory, there are categorical rules at each level and these rules are the constraints on the categories of items and on the combinations of categories that are acceptable (Abel and Babel, 2017). The rules at each level define categories appropriate to that level (Abel and Babel, 2017). The current study is concerned with the breathing rates for stutterers in both singing and speaking and understanding the four levels of speech can help the researcher to understand the stutterers' speech better and hopefully come up with the concrete evidence regarding the breathing rates for stutterers in both singing and speaking.

Field (2004) suggests that a cognitive theory would link stuttering to listening and self-monitoring. This statement suggests that there may be split second delays in the auditory feedback mechanism linking the ear, brain and vocal organs which disrupt the encoding and dysfluency of speech. Meanwhile, Centre for Stuttering Therapy (2010) states that 'We do not know why people stutter, but apparently it is not a nervous or personality disorder. People who stutter are normal except they lack the ability in varying degrees to get words out fluently'. This implies that it is still not simple to single out any cause of stuttering. Therefore, researchers look at any relating feature to the cause of stuttering. However, the current research is mainly focused on the breathing rates and patterns of stutterers and non-stutterers to see if there is any difference during singing and speaking.

According to Ferrand (2013), numerous different categories of models and theories of speech production exist, such as target models, feedback-feed forward models, dynamic systems theory, and connectionist theories. However, these are categorised. Most theories of speech production try to address three major issues related to the organisation and regulation of speech motor

control. These include how speech is ordered serially, the problem of degrees of freedom, and the question of context sensitivity.

1 The Serial-Order Issue

Although the output of speech is continually a varying waveform, the linguistic elements that make up speech are produced in a serial order. The order is important for meaning: the phonemes /k/ and /t/ are used in the words cat, tack, and act, the order in which they are produced determines how the word will be perceived and recognised. Speech is thus a sequence of elements. The question is precisely which elements are serialised. The elements could be specific features of a sound (e.g. voicing or nasality), phonemes, syllables, parts of syllables, or other larger or smaller elements.

This theory will be the base of this study as it relates and addresses question 6 of the questionnaire in that, if the stutterers can identify the order of sounds that make them stutter, they can come up with the re-solution of either breaking the order, re-arranging or using a synonymy of that particular word.

2 Degrees of Freedom

When people speak, they need to control a huge number of muscles, including those of the respiratory, laryngeal, and articulatory systems (Ferrand, 2013; Quesal and Yaruss, 2017). In addition, many structures in these systems can move in different ways, at different speeds, and in different combinations. For example, the lower lip and jaw can move in phase with each other and in the same direction or out of phase with each other but in the same direction; or in phase with each other, but in opposite direction. Each different potential muscular contraction of each

muscle in each system constitutes what is known as a degree of freedom, so the total number of theories of speech production turns to ensure that the appropriate structures are moving rapidly and in the correct sequences to generate the target sounds and words.

Many theories have been put forward to explain how the speech motor system achieves this level of control. Some theories propose that the speech motor system 'program[me]s' separate neuromuscular signals for each required muscle contraction. Another class of theories organises muscular control in a hierarchy, with upper levels of the system controlling lower levels. Still, other theories suggest that the speech motor system uses various strategies to reduce the total number of degrees of freedom to a smaller number, for instance, by combining muscles into functional groupings that work in a coordinated fashion to achieve a desired goal. In this way, muscles are controlled in groups, rather than individually (Ferrand, 2013).

This theory is relevant to the current study especially concerning the muscle control of respiration during speaking. As much as the current study does not go in details for muscle control of respiration during speaking, it does however assess the breathing rates of stutterers and non-stutterers when singing and speaking trying to check if the respiration can be blamed for occurrence of stuttering during speaking.

3 Context-Sensitivity

According to Ferrand (2013), the problem with theories of speech production is that, they need to take into account the fact that sounds vary with the context in which they are produced and are influenced by speaking rate, stress, clarity of articulation, and other factors. Co-articulation is an integral aspect of speech production that results in enormous variability in the production of a

target sound. A given speech sound often can be produced in several different ways, and this variability in production is a central factor in speech motor regulation.

This theory is adopted as the present study seeks to find out the factors that influence a person to stutter, that is, whether people stutter most when they speak in a faster rate, when they are stressed, in a formal situation or any other factors. The environment in which the stutterer is in, can increase or decrease stuttering.

4 Target model theory

Theories of speech production target models describe speech production as a process in which a speaker attempts to attain a sequence of targets corresponding to the speech sounds he is attempting to produce (Ferrand, 2013). Some theorists have suggested that these targets are spatial. Spatial target models posit that there is an internalised map of the vocal tract in the brain that allows the speaker to move the articulators to specific regions within the vocal tract. The speaker can achieve the targets no matter from what position the articulator(s) begin(s) the movement. The fact that articulators must reach a particular position from different starting points is important, because it means that the movements of the articulator for a specific sound cannot be invariant, but must change depending on the starting point. For example, to achieve the velar target for the /k/ sound, the tongue would have to move in a different trajectory depending on the preceding vowel. The path of the tongue would vary, for instance, to produce a dental sound /t/.

This theory is not relevant to the present study. However, the curiosity is, if there is an internalised map for humans allowing different speech sounds to be produced, why is it that some stutterers may have a problem articulating some sounds especially at certain sound

positions, but still manage to produce such sounds fluently at the different sound environments. The stutterers identifying the sounds that make them stutter over others can help understand that, certainly, there is an internalised map though the current study cannot guarantee that the internalised map was initially inserted together with the sound (s) pattern that follow a particular route .

2.11 Conclusion

It is evident that stuttering disorder is not as simple as some people may suppose. Different researchers together can bring light to the origin of stuttering within the human physiology. It is better for researchers if they can focus on how to stutter less than not stuttering at all because as far as the origin of stuttering is still unknown, it will be challenging to propose mechanisms that prohibit stuttering at all. The information provided in this chapter suggests that stuttering has a strong genetic influence which upon advanced research can be rooted or prohibited to spread through the genes.

There is a relationship between speaking, singing and breathing as shown in this chapter. It is the view of the current study that thorough research in the three related activities (speaking, singing and breathing) there can be a clue to the cause of stuttering. With the common knowledge in linguistics, there is no speech production without air. The regulation of air can bring a huge difference for stutterers because stutterers manage to sing with less stuttering issue. Knowing exactly how much air is needed for stutterers to stutter less can help control the disorder.

CHAPTER THREE: METHODOLOGY

3.1 Introduction

This chapter outlines the research approach, research design, population, sample and sampling technique, ethical considerations, data collection, data analysis and conclusion of the entire chapter. This is the core chapter of the entire study that connects the problem statement, research questions and the analysis of data. It outlines the steps to collect and analyse data so that the general conclusion can be drawn in the next chapter.

3.2 Approach

The study followed a mixed method research approach (qualitative and quantitative) because of the instruments used in collecting and analysing the data. The qualitative method allows the researcher to explore, understand phenomena, answer questions by analysing and making sense of unstructured data, interviews and observations (Atkinson & Delamont 2001). Qualitative research is more subjective, including observation and interpretation of data through ethnography and personal interviews (Moss, 2017).

Quantitative methods emphasise objective measurements and statistical, mathematical or numerical analysis of data collected through polls, surveys, questionnaires or by manipulating pre-existing statistical data using computational techniques, (Labaree, 2009). Quantitative research focuses on gathering numerical data and generalising it across groups of people or to explain particular phenomena. According to Smith and Shorten (2017), mixed method approach demands collecting and analysing data both qualitatively and quantitatively. It draws on potential strengths

of both qualitative and quantitative methods allowing researchers to explore diverse perspectives and uncover relationships that exist between the intricate layers of multifaceted research questions. It requires purposeful mixing methods in data collection, data analysis and interpretation of the evidence. According to Padgett (2012), the new era of mixed integration can be seen as a pragmatic response on the part of researchers wanting to maximise their understanding of a particular problem. Padgett further posits that the mixed method is formally referred to as multi-method or triangulation by method and it has the following features;

- All the research design operates from a premise of intentionality and mixed methods design point to the desire to link or integrate.
- Designing a mixed method study involves two primary axe-sequential versus concurrent and dominant versus equal. Patgett (2012) postulates that dominant refers to which method is given more weight and prominence in the study.

The mixed method approach is appropriate for answering questions that neither qualitative nor quantitative methods could answer on their own. It can be used to gain better understanding of connections or contradictions between qualitative and quantitative data; they can provide opportunities for participants to have a strong voice and share their experiences across the research process and they can facilitate different avenues of exploration that enrich the evidence and enable questions to be answered more deeply. The approach facilitates greater scholarly interaction and enriches the experiences of researchers as different perspectives illuminate the issues being studied. The mixed method is adapted in this study because of the reasons below which are articulated by Creswell and Clark (2011):

- Triangulation which enables convergence, corroboration and correspondence of results from different methods.

- Complementarity which enhances elaboration, enhancement, illustration and clarification of the results from other method.
- Development which enables the researcher to use the results from one method to help develop or inform the other method.
- Expansion which permits the researcher the depth and range of inquiry through the use of different methods.
- The other reason is offset which suggests that both quantitative and qualitative research have the strengths and weaknesses. So combining allows the researcher to offset their weaknesses and draw on the strengths of both.
- Enhancement of explanation: the use of mixed methods helps the researcher to explain the findings generated by the other method.
- Mixed methods caters for unexpected results, therefore combining quantitative and quantitative can be fruitful when one method generates surprising results that can be understood by employing the other.
- Another reason is credibility which enhances the integrity of the findings.

However, the mixed method approach is limited in that it often requires more resources (time and personnel) and additional research training, as multidisciplinary research teams need to become conversant with alternative research paradigms and different approaches to sample selection, data collection, data analysis and data synthesis or integration.

3.3 Design

Research design is a systematic plan to study a problem (Dey, 1993). It is also a plan to answer the research question (Virginia Tech, 2018). Research design and method are different but closely related; good design ensures that data will help answer research question more effectively (Virginia Tech, 2018). According to Labaree (2009), research design usually refers to the overall strategy used to integrate the different components of the study in a coherent and logical way ensuring that it will effectively address the research problem; it constitutes the plan for the collection, measurement and analysis of data.

The present study is correlational in nature and as a result, the convergent parallel design was most suitable. The convergent parallel design concurrently conducts the qualitative and quantitative elements in the same phases of the research process, weighs the methods equally, analyses the two components independently and interprets the results together (Demir, 2018). The purpose of the convergent parallel design is to simultaneously collect both qualitative and quantitative data, merge the data and use the results to understand a research problem (Ghina, n.d). A basic rationale for a convergent parallel design is that one data collection form supplies strengths to offset the weaknesses of the other form and that a more complete understanding of a research problem results from collection both quantitative and qualitative data (Ghina, n.d). He further notes that the researcher gathers both quantitative and qualitative data, analyses both data sets separately, compares the results from the analysis of both datasets, and makes integration as to whether the results support or contradict each other. The direct comparison of the two datasets by the researcher provides a convergence of data sources (Ghina, n.d). In the same way, the results of the present study collected from the qualitative and quantitative data is used to support or contradict each other in relation to the research questions.

3.4 Population

Population is a complete set of elements that possess some common characteristic defined by the sampling criteria established by the researcher (University of Missouri- St Louis (UMSL), n.d). Population is a group of all individuals or units of interest; typically there is available data for almost all individuals in the population. According to Pilot and Hungler (1999), population is the aggregate or totality of all the objects, subjects or members that conform to a set of specifications. The population is the broader group of people to whom the researcher intends to generalise the results.

According to Alvi (2016) there are types of population in which the interest is on target population which refers to all the members who meet the particular criterion specified for a research investigation. He further notes that there are classes of population: homogeneous and heterogeneous population. The homogeneous population refers to elements that are similar to each other in all aspects while heterogeneous refers to the elements that are not similar to each other. The variables that make the population heterogeneous vary greatly from research to research and some of the variables that make the population heterogeneous include gender, age, ethnicity and socioeconomic status (Alvi, ibid). However, it is possible to have the same population being homogeneous and heterogeneous depending on the goal and nature of the research (Alvi, ibid).

The populations for the present study were the students and staff members of the National University of Lesotho (NUL). In this study both males and females between the ages of 20-40 were considered as research participants because the focus for the present study is for stutterers with persistent developmental and neurogenic stuttering. The preferred number of participants

was determined by the number of participants available since participating in this study was mainly based on voluntarily act of the participants.

3.5 Sample and sampling techniques

Sample is the selected element chosen for participation in a society (Cooper and Schindler, 2003). It is the subset of the population. Sampling is the process of selecting a group of people, events, behaviors or other elements with which to conduct a study (Cooper and Schindler, ibid). There are different types of sampling techniques. The current study made use of purposive, snowball sampling and self-selection techniques. The above mentioned sampling techniques fall under non-probability sampling techniques because they require voluntary act at the end no matter the referral or not. The self-selection sampling requires the participant to initiate after reading a poster from the notice board without any influence from the other people (Magashane, 2015). The purposive sampling is sometimes known as judgmental or expert choice sampling. In purposive sampling, the researcher uses personal judgment to select participants that are considered to be representative of the population, the participants are usually handpicked and typical participants experiencing the problem being studied (Cooper and Schindler, ibid).

Purposive sampling in qualitative circles is also referred to as non-probability sampling (The Academic Triangle, 2016). It is a strategy where members of a sample are chosen with a purpose to represent a location or type in relation to the criterion (The Academic Triangle, ibid). Dolores and Tonglo (n.d) declare that purposive sampling is the deliberate choice of an informant due to the qualities the informant possesses and it is a no-random technique that does not need underlying theories or a set number of informants. In purposive sampling, the researchers rely on their experiences, ingenuity and/or previous research findings to deliberately obtain participants

in such a manner that the sample obtained may be regarded as representative of the relevant population. The main advantage of purposive sampling is that of the ability to critically think and define the parameters of the population that is intended to be studied at an early stage. However, purposive sampling is usually bias because some researchers will opt for it so as to select their colleagues and acquaintances. In the current study, the purposive sampling technique was used purposely to approach stutterers.

Snowball sampling on the other hand is also known as network sampling. The participants refer the research to others who might be recruited in the study (Padgett, 2012). Snowballing sampling or chain referral is a technique where the subjects refer the researcher to other subjects of the same nature that is been studied (Summer, 2001; www.columbia.edu, n.d). It is a strategy for obtaining respondents where they are few in number or where some degrees of trust is required to initiate contact (Summer, 2001). This process is based on the assumption that a bond or link exists between the initial sample and others in the same target population allowing a series or referral to be made within a circle of acquaintance (Berg, 1988). In the first phase of this kind of sampling, a few individuals from the relevant population are approached. These individuals then act as informants to identify other members from the same population for inclusion in the sample. The latter may in turn identify a further set of relevant individuals so that the sample as a rolling snowball grows in size (Padgett, 2012). The advantage of snowball sampling is that it may be applied as a more formal methodology for making inferences about a population of individuals who have been difficult to enumerate through the use of descending methods such as household surveys (Summer, 2001). However, there are some limitations to snowball sampling according to Summer (2001) as listed below:

- Because elements are not randomly drawn, but are dependent on the subjective choices of the respondents first accessed, most snowball samples are biased and do not therefore allow the researcher to make claims to generality from a particular sample
- Snowball samples are biased towards the inclusion of individuals with interrelationships and therefore over-emphasise cohesiveness in social networks and will miss isolates' who are not connected to any network that the researcher has tapped into.

In the current study, the researcher looked for stutterers in NUL campus. This was possible through the help of the stutterers, students and staff members by telling the researcher about stutterers that they know. The researcher approached the target participants and informed them about the ongoing study where ethical issues were considered. Then people willing to participate were considered as participants in the present study. Prior to participation, a consent form as appended in appendix 3 was submitted to them, together with the questionnaire as appended in appendix 1.

3.6 Ethical considerations

Ethical considerations are the norms or standards for conduct that distinguish between right and wrong and they help determine the difference between acceptable and unacceptable behaviours (Struwig & Stead, 2001). Because ethical considerations are so important in research, many professionals and agencies have adopted codes and policies that outline ethical behaviour and guide researchers: the codes address issues such as honesty, objectivity, and respect for intellectual property, social responsibility, confidentiality and non-discrimination (Huysamen,

2001). Ethical considerations are very important in research especially considering human subjects. In order to address rightly the human subjects in research, most organisations and institutions have developed an Institutional Review Board (IRB) which is a panel of people who help to ensure the safety of human subjects in research and make sure that human rights are not violated (Huysamen, ibid).

Research also indicates that research participants do not owe anything to the researcher and they are entitled to be treated with respect, dignity and courtesy. It is also suggested that if subjects are fully informed about the reasons for research, even if there is no possibility of physical pain or discomfort, they lose interest and highly unreliable results are likely to be obtained. Therefore, according to Huysamen (ibid), the researcher has to abide by the following principles listed below:

- Maintain justice which entails respect the privacy of research participants. Privacy includes one's attitude, beliefs, behavior, opinion, confidentiality ad anonymity.
- Avoid exposing participants to physical and psychological pain and discomfort.
- Let individuals participate under false pretense which is ethically less objectionable than to have individuals participate without their knowledge or under coercion.
- Consider the consent form if the subjects are to be subjected to physical or psychological discomfort. To put it differently, prospective subjects should be informed objectively and honestly about any discomfort they are likely to experience.
- Explain the purpose of the research to the subjects.
- Explain the importance of the research to the subjects.

- Explain to the prospective subjects that the study is not concerned with their individual performance or reactions but with the average trends which are to be obtained for groups such as theirs.
- Give the subjects freedom to ask questions which should be answered by the researcher.
- Respect for persons' withdrawal or refusal to provide information.

In research, human subjects are used in order to understand the disease, validate new therapies, understand physiological processes, study human behaviour, evaluate curricular changes, or evaluate new teaching methods among others (Huysamen, ibid). Since the most important aspect for this study was to provide the appropriate breathing range for stutterers in line with the already existing research that perhaps the regulated breathing rates can reduce stuttering for stutterers, a detailed letter of ethical considerations was submitted to each participant prior to data collection and the participants informed the researcher once they were content with the ethical considerations covered in the letter. Among other things included in the letter were:

- Anonymity
- the participants' freedom to leave (quit) anytime they feel uncomfortable
- use of transcribed data
- No physical or psychological pain
- No impact on academic or personal life
- Freedom to ask questions

3.7 Data collection

Data collection is the process of gathering and measuring information on variables of interest in an established systematic fashion that enables the researcher to answer research questions, test hypotheses and evaluate the outcomes (The Office of Research Integrity, n.d). According to Mouton (2002), during data collection the researcher collects various kinds of empirical information or data: for instance, historical, statistical or documentary data. Mouton (ibid) further denotes that this is accomplished through various methods and techniques such as content analysis, document analysis, interviewing, psycho-metric testing. He also posits that there are number of methodological criteria that ought to be followed during the process of data collection. These include suspension of personal prejudices and bias, systematic and accurate recording of the observations, establishment of trust and rapport with the interviewee and creating optimal conditions in terms of location or setting for data collection. Inaccurate data collection can impact the results of a study and ultimately lead to invalid results (Dey, 1993). The convergent parallel design to be used in this study allows the researcher to collect data quantitatively and qualitatively independently then merge the results and analyse. For this study, data was collected in two different ways for stutterers and non-stutterers. For stutterers, a questionnaire was provided and responded to by the stutterers.

The second method of data collection followed. With the second data, the following tools were used:

- Armpit clinical thermometer
- Digital blood pressure monitor to detect both blood pressure readings and the pulse rate
- Breath monitor application in the tablet of the researcher

This second method of data collection (breath rate analyses in relation to temperature, pulse and blood pressure) was applicable to both stutterers and non-stutterers. This was the section where the breathing rates had to be assessed. This is based on Pietro (2019) who asserts that breathing rates are better assessed in relation to temperature, blood pressure, pulse and oxygen saturation. However, for the current study oxygen saturation was excluded due to specific instruments, laboratory and limited time. The twenty participants were carefully assessed with each participant providing suitable day and time for them to be assessed, as well as providing a suitable place for them to provide data. As much as the theme of the study was to assess the breathing rates during singing and speaking, the breathing rates at rest and after the activity were also assessed so as to identify any change in temperature, pulse, blood pressure and the breathe rates. The format for the second data collection was as tables in chapter 4.

In the current study, the researcher requested the participants to sing the Lesotho national anthem from which data was collected to record the rates of stutterers' breathes. The general discourse like asking the participants about their hobbies was used to cater for the speaking session of the study. Both sessions were timed equally for a fair analysis to be made. The researcher inquired from the participants (each) to suggest a place they thought was comfortable for them during data collection. Then, the researcher followed as suggested by the participants. For instance, for ethical considerations, only the researcher and the participant were in a private room where the participants were monitored during singing and speaking for the duration of 4minutes, for each participant per session. As the participant were monitored, before singing and speaking, the temperature, pulse, blood pressure and breaths were noted on the sheet to be analysed later as in chapter 4. During singing and speaking, only the breath rates were noted and after these two activities, the temperature, pulse, blood pressure and breath rate were monitored again.

3.8 Data analysis

Mixed method data involves analysing data from the qualitative and quantitative approaches used in the study. Regardless of how data was collected, there are general procedures regarding data analysis for mixed method (Moss, 2017).

The study introduced the operational breathing rate range which is 12-20 per minute in line with Drost *et al.* (2013) to mark the normal breathing rate in both activities (singing and speaking). Any range below or above the suggested one was interpreted negatively to mean either too high or too low. As much as there was an operational breath rate for the study, finally the new ranges were proposed for stutterers when they sing and speak in relation to the current data of the study. For temperature readings, the operational normal temperatures for the current study were between 35.0º C- 39.0º C. the blood pressure (Bp) reading were adopted from Thibodeau and Patton (2010) where they state that the normal range for Bp is -120/-80, pre-hypertension 1120-139/80-89, stage 1 hypertension 140-159/90-99 and stage 2 hypertension 160+/+/-100. The pulse rate readings were adopted from MacGill (2017) where he notes that the normal resting heart rate for 10 years-adults ranges between 60-100 per minute.

3.9 Conclusion

This chapter has presented the reader with the methodology that was used in collecting, analysing and interpreting the data under study. The mixed method approach allows exploring data and data analysis from several angles. In this study, the mixed method approach was purposely selected in order to explore data and analyse data from multiple angles to allow a fair analysis and meaningful conclusion. The data and results of this study can be archived for future use in order to develop the idea towards stutterers' breathing range. This study using a mixed

method methodology can be a starting point for a researcher interested in using one research design and further advance the findings of this study.

CHAPTER FOUR: DATA ANALYSIS AND FINDINGS

4.1 Introduction

This chapter deals with the data collected, the analysis and the findings of the study. The male stutterers are represented by (MS) and the females stutterers are presented by (FS). The data is analysed based on the two methods of data collection: questionnaires and the assessment of the breathing rates in relation to temperature, blood pressure, pulse rate and breathe rate. The data where the respondents were examined is presented in four tables that consist of data from female stutterers (FS), female non-stutterers, male stutterers (MS) and male non-stutterers.

4.2 Data presentation and analysis

This section presents the data that was collected through the use of a questionnaire and the examination tools; armpit thermometer, digital blood pressure monitor to provide readings for the blood pressure and the pulse rate and lastly the breath monitor to provide readings for the breath rate per minute. It also deals with the analysis of the collected data with the view of identifying how temperature, blood pressure, pulse rate and breathe rate affect the stuttering.

4.2.1 Data presentation

The first set of data was collected through the use of the questionnaire which is appended in appendix 1. The questionnaire was made up of six questions and responded to by seven MS and four FS respondents. The first question aimed at identifying the participants with regard to their gender. The responses to the question revealed that of the eleven participants, seven were males while four were females.

The second question sought to know the environment and circumstances that cause the participants to stutter more. To this question, the following responses were obtained:

Males	**Females**
-when nervous -argumentative space, and when speaking Sesotho language -angry, excited, extreme pressure and when rushing -when angry -when I am excited, nervous-though sometimes it just happens for no explicable reason -formal meetings -ha ke koatile/halefile (when I am angry or anxious)	-uncomfortable environment -in a formal setting -when I talk continuously -all environments

Question three focused on identifying the environment or circumstances that causes the participants to stutter less. The responses to this question were as follows:

Males	**Females**

-when calm and not controlled by emotions -a relaxed space and when speaking English language -When calm and carefully controlling my speech -when there's no quarrel -when I am relaxed and in control -when I am happy -when I am relaxed	-chilled and comfortable environment -calm, relaxed environment and informal setting -when I do not talk in a continuously manner -non-specific; it just happens at times

The aim of the fourth question was to establish the age at which the participants realised that they were stutterers. To this question, the following responses were obtained:

Males	**Females**
-as far as I can remember -6 years -6 years -not sure, but as far I can remember	-11 years -as far as I can remember -I really cannot remember -12 years

-not really sure, probably at 5 and 6 years -13/14 years -12 years	

Question five sought to know if there are any stutterers in the families of the respondents. To this question, one participant said no while the other respondents all said yes there are stutterers in their families.

The last question aimed at identifying any particular sounds, words and phrases on which the participants stutter on. To this question, the following responses were obtained:

Males	**Females**
-long words -not specific because it happens during a conversation in most or less words -no (not specific) -people's names, uncommon words that often begin with /n/ or /m/ -not really sure I used to struggle to say NTTC but not anymore	-/v/ and /f/. When /v/ follows /ʃ/ in one word. E.g. invasion or words formed from affixation e.g. concatenated -initial combination of sounds that has /r/ e.g free, tree, three -words such as restricted, neurological and dyscalculia -most words that I cannot specify

-the word approximately and the sound /d -it happens on frequent words that I cannot specify	

The second set of data was obtained through measuring the temperature, blood pressure, pulse and breathing rate of the participants. In collecting this set of data, the participants included the eleven stutterers and ten non-stutterers-five males and five females. The tables in the following pages present data collected in relation to temperature (Temp), blood pressure (Bp), pulse and breathe rate (Br). These four aspects were considered or noted while the participants were at rest, during singing and speaking where only the Br was considered and all the four were again considered after the two activities (singing and speaking). The highlighted numbers (units) signify the abnormal values that were acquired beside a specific aspect in the following manner:

Normal font color- normal readings for temperature, blood pressure, pulse and breath rates.

Red- non descriptive blood pressure readings

Green- pre-hypertension

Purple- stage 1 hypertension

Yellow- stage 2 hypertension

Dark blue- lower pulse readings

Nude – higher pulse readings

Light blue – Higher breath rate

Bold – lower breath rate

Brown – lower temperature readings

The data collected is presented below:

Table 1: Male stutterers

No	**BEFORE**			**DURING**			**AFTER**		
1	Temp Bp Pulse Br	35.0˚C 128/74 80 15	**32.0˚C** 107/77 84 18	Singing Br Speaking Br	18 16 	14 18 	Temp Bp Pulse Br	**33.2˚C** 119/74 80 **21**	**32.9˚C** 115/79 82 19
2	Temp Bp Pulse Br	35.5˚C 110/62 69 15	35.6˚C 103/63 64 16	Singing Br Speaking Br	12 **33** 	12 **35** 	Temp Bp Pulse Br	35.6˚C 100/60 60 13	35.7˚C 104/61 62 14
3	Temp Bp	35.1˚C 117/81	35.8˚C 115/85	Singing Br	12 	13 	Temp Bp	36.1˚C 112/93	36.0˚C 104/79

	Pulse Br	60 13	**59** 14	Speaking Br	**11**	15	Pulse Br	64 17	65 15
4	Temp Bp Pulse Br	35.1˚C **125/81** **53** **9**	35.7˚C 129/69 77 15	Singing Br Speaking Br	12 12	12 **9**	Temp Bp Pulse Br	**34.5˚C** 121/83 **51** 14	**34.6˚C** 122/81 **53** 13
5	Temp Bp Pulse Br	36.2˚C 106/88 65 **10**	35.6˚C 121/103 **59** **9**	Singing Br Speaking Br	18 **9**	12 **9**	Temp Bp Pulse Br	35.5˚C 129/73 **59** 15	35.3˚C 131/67 61 **8**

Table 2: Female stutterers

No	BEFORE			DURING			AFTER		
1	Temp Bp Pulse Br	36.0˚C 111/68 76 15	36.1˚C 109/75 73 14	Singing Br Speaking Br	12 21 	13 16 	Temp Bp Pulse Br	36.2˚C 101/69 74 18	36.2˚C 101/70 74 16
2	Temp Bp Pulse Br	36.0˚C 100/71 78 16	36.0˚C 101/76 80 19	Singing Br Speaking Br	13 **8** 	14 12 	Temp Bp Pulse Br	36.0˚C 94/74 77 18	36.1˚C 104/77 78 19
3	Temp Bp Pulse Br	36.0˚C 134/66 79 16	35.9˚C 106/67 74 17	Singing Br Speaking Br	13 **11** 	13 **8** 	Temp Bp Pulse Br	36.2˚C 105/63 74 18	36.1˚C 99/67 79 17
4	Temp Bp Pulse	36.0˚C 92/62 87	36.2˚C 102/73 87	Singing Br Speaking	8 24	13 14	Temp Bp Pulse	36.5˚C 103/68 100	36.2˚C 89/66 87

	Br	14	13	Br			Br	12	14

Table 3: Male non-stutterers

No	**BEFORE**			**DURING**			**AFTER**		
1	Temp Bp Pulse Br	35.1˚C 128/48 **48** 18	35.0˚C 106/41 67 13	Singing Br Speaking Br	9 13 	11 12 	Temp Bp Pulse Br	35.5˚C 118/55 65 15	35.0˚C 117/45 74 15
2	Temp Bp Pulse Br	36.1˚C 168/46 **110** 11	35.9˚C 125/73 100 13	Singing Br Speaking Br	19 **25** 	12 12 	Temp Bp Pulse Br	36.3˚C 169/50 80 15	**34.6˚C** 115/65 81 12
3	Temp Bp Pulse Br	**32.9˚C** 121/69 96 **11**	36.5˚C 113/52 98 **9**	Singing Br Speaking Br	15 **25** 	21 18 	Temp Bp Pulse Br	36.4˚C 105/89 **110** **30**	36.2˚C 112/67 **106** 17
4	Temp	36.5˚C	36.0˚C	Singing	20	13	Temp	36.2˚C	36.1˚C

	Bp Pulse Br	118/76 108 14	114/78 91 21	Br Speaking Br	12	13	Bp Pulse Br	128/69 60 11	111/68 69 19
5	Temp Bp Pulse Br	36.2˚C 138/66 77 18	36.0˚C 73/52 85 31	Singing Br Speaking Br	21 16	15 15	Temp Bp Pulse Br	35.8˚C 108/81 76 14	36.0˚C 110/75 77 **9**

Table 4: Females non-stutterers

No	**BEFORE**			**DURING**			**AFTER**		
1	Temp Bp Pulse Br	36.2˚C 98/57 73 13	36.5˚C 90/59 79 12	Singing Br Speaking Br	12 14	13 12	Temp Bp Pulse Br	36.2˚C 79/50 77 13	35.5˚C 86/54 77 14
2	Temp Bp Pulse	36.7˚C 101/67 78	36.8˚C 96/64 78	Singing Br Speaking	16 12	15 21	Temp Bp Pulse	36.7˚C 108/77 76	36.7˚C 101/74 77

	Br	12	12	Br			Br	**11**	12
3	Temp Bp Pulse Br	35.3˚C 105/71 **109** 18	35.6˚C 104/66 100 18	Singing Br Speaking Br	12 **10** 	12 15 	Temp Bp Pulse Br	36.3˚C 95/68 **104** 15	36.0˚C 97/69 **101** 18
4	Temp Bp Pulse Br	36.0˚C 126/73 **101** **10**	36.9˚C 118/74 **101** **10**	Singing Br Speaking Br	17 15 	16 15 	Temp Bp Pulse Br	35.8˚C 129/69 98 15	36.4˚C 125/71 **101** 17
5	Temp Bp Pulse Br	35.3˚C **126/90** 94 16	36.0˚C 119/83 92 18	Singing Br Speaking Br	19 15 	13 17 	Temp Bp Pulse Br	36.2˚C **128/89** 92 17	**34.7˚C** 118/92 86 16

4.2.2 Data Analysis

This section analysis the data presented in 4.2.1 with a view to answer the research questions of this study. The analysis is presented in two sections based on the nature of the data collected.

4.2.2.1 Analysis of data from the questionnaire

This section analysis the responses to the six questions in the questionnaire.

With regard to question one, Frigerio-Domingues and Dryayna (2017) indicate that stuttering affects more males than females just like a number of neurodevelopmental disorders. This evidence suggests why it was easy to have more male stutterers (MS) than female stutterers (FS) in this study. Hence this could mean more males are affected by stuttering than females at NUL campus.

As far as question two is concerned, the female responses vary greatly except for one lady who said she stutters in all the environments. Each female had a specific setting that triggers their stuttering issue. For the lady who said she stutters in all the environments, her response could imply that she can either stutter in an uncomfortable environment, formal setting or when she talks continuously which are all the responses provided by other FS. In all the four responses, the interesting one was the one that said "I stutter when I speak continuously". A follow up verbal interview had to be conducted regarding this response and the interviewee mentioned that she stutters when she talks continuously like in narrating a story or speech delivery that needs her to talk consistently.

The MS responses however have common features in general as they mostly have a nervous or anxious character in them. The literature in relation to stuttering and nervousness as according to

Alm (2004) claim that often people who stutter report that their stuttering is influenced by emotional reactions; though the nature of such a relation is still unclear. Psychological studies of stuttering have failed to find any major association between stuttering and the activity of the sympathetic nervous system (Alm, 2004). The relation between stuttering and emotional factors has long been a matter of debate (Alm, 2004) and the two most thorough studies in this field Peters and Hulstijn (1990) and Weber and Smith (1990) failed to find any significant overall group differences in sympathetic activation between the stuttering and non-stuttering, either at rest or in relation to speech or non-speech tasks. These studies in relation to the present study mean that as much as research is concerned there is no evidence that proves direct relationship of stuttering and emotions. As much as research is concerned, however, the present data can be used to interpret that perhaps the emotions play a vital role in triggering stuttering more on stutterers based on the number of MS who suggest that they stutter more when they are anxious, angry, excited or nervous. Five of the seven MS participants indicated that anxiety, nervousness, excitement and anger as factors that trigger their stuttering more. Therefore, this means that 71% of the MS participants designated that the four emotional states (nervousness, excitement, anxiety and anger) trigger their stuttering more.

Still on the issue of emotions and stuttering, Packman Menzies and Onslow (1999) reviewed the existing literature on stuttering and anxiety and came to the conclusion that the lack of evidence for a relationship between stuttering and anxiety may be a result of inadequate research designs regarding definitions and measures of anxiety, insufficient power or inappropriate speech tasks. Fraser (2010) however notes that substantial influence on progress in therapy should include feelings and emotions, tension and relaxation, distractions, enlisting help from others and one's determination or motivation in order to overcome the awkward environments faced by stutterers,

anxiety and tension. Fraser (2010) supports the idea or view that emotions and feelings do actually have a relationship with stuttering hence the responses for the current study through its data adds on that. In general, question two and three respond to the research question that was concerned with the environment that makes stutterers stutter less or more. Precisely, the research question is responded in that yes there are specific locations that make stutterers stutter more and less depending on one's feelings and emotions.

Concerning question three, all the participants indicated that there are specific features and environment that lead them to stutter less. The fact that all the participants in this study have a certain feature or specific location that makes them stutter less, this can however be used as a self-therapy tool in that they should or they may manage to control their feelings and emotions in relation to when they are in awkward moments. Identification of the awkward environments or moments by the stutterers can be used to their advantage as they can learn the things that they do when they stutter less and those factors can be used when they are in environments that make them stutter more. Hence a self-therapy strategy can be applied.

There are two exceptions for MS: one who said he stutters in an argumentative space and when speaking his first language than the second language, and the second one who said he stutters in a formal setting. The second response that talks about the formal setting is similar to one FS response who said that she has a problem with the formal meeting as well. This formal setting could be interpreted in the same way as uncomfortable environments. Perhaps the formal setting makes them uncomfortable and as a result triggers stuttering more.

In relation to question four, the disorder typically arises in childhood often as speech and language skills are rapidly developing (Frigerio-Domigues and Dryana, 2017). Developmental

stuttering does not exist at birth, rather it emerges in the pre-school years due to complex interactions of speech motor and other neural systems (Smith and Denver, 2015). In the present study, two of the FS, which is 50% denote that they were about 11-12 years when they became aware of their stuttering issue while the other two convey that they were aware of their stuttering issue for as long as they can remember in their childhood. They indicated that they cannot even specify the age because it happened at a very tender age. On the other hand, three of the MS, which is 42% of indicated that they were aware of their stuttering issue between the ages of 11-12 years; two of them that is 29% of MS declare they were aware of stuttering of their stuttering issue at the age of 12-14 years and two of them that is 29% of MS suggest that stuttering has been an issue in their lives for as long as they can remember.

There is a relationship in the MS and FS in that two participants from each group do not remember when exactly their stuttering issue started and two participants from each group remember having stuttering issues between the ages of 11-14 years. The exception range is for the MS who remembered being stutterers from as early as 5-6 years. This exception group is presented by a fraction three of the seven MS.

While the underlying causes of stuttering have been speculated upon since antiquity, in the past four decades, evidence for the involvement of genetic factors in this disorder has steadily accumulated (Frigerio-Domingues and Dryna, 2017). The genetic effect of stuttering has lead it to accumulate more than any other form of stuttering (Frigerio-Domingues and Dryana, 2017). This suggests that as much as developmental stuttering does not exist from birth, the genetic impact on the spread of stuttering has increased and chances are that most people acquire it that way. This is also true based on the data presented in the current study. All the four FS acknowledge that they acquired stuttering genetically while a total number of six out of the seven

MS, that is 86%, said they acquired stuttering as a result of genetic impact. This proves that genetics play a significant role in the spread of stuttering.

From the data presented, the stutterers both MS and FS identified the environments that make them stutter more and less respectively. The last question is however concerned with the specific words or sounds that the stutterers encounter difficulty in pronouncing. Each participant denoted a list of words or pattern that is not easy for them to pronounce. For the FS two out of the four (50%) participants were able to identify the exact sound patterns that are difficult for them stating the order sounds of /fr-/, /tr-/, /θr-/ and /v/ followed by /ʃ/ in one word. One of the four FS participant noted words such as *re**str**i**c**ted*, *neurologi**c**al* and *dysca**lc**ulia*. Although the participant did not pronounce the words aloud for the researcher to hear the sounds that are difficult for her in these words, the similarity in all the words is the /k/ sound which can be assumed to be the obstacle and the sound order of /-str-/ for the first word and that of /-lk-/ for the last words. This assumption is based on the sounds patterns identified by other two FS in the same question. The last FS participant said she stutters often so much that she cannot specify any words or sounds.

As for the MS participants, three of the seven participants revealed that their stuttering happens frequently and so cannot specify certain sounds or words. One of them said it happens on uncommon names that begin with /n- and m-/ sounds. This identification is common in terms of the position of the sounds to the FS who stated the initial position of /fr- and tr-/ sounds. Another one noted that he used to struggle with the abbreviation NTTC but not anymore. One other participant noted that the sound /d/ is problematic to him though he did not state in which word position. He went on to say and that the word *a**ppr**oximately* is also problematic. Perhaps the double consonant is an issue in relation to the double consonants of the abbreviation N**TT**C. The

word approximately can be grouped with the word restricted and the sounds /fr-, tr- and –str-/ as they have a similarity of the /r/ sound either in the initial position or median position. The exception for the MS is the one who said he stutters on long words and these long words are non-specific.

In relation to the MS who said he stutters on longer words, the Stuttering Foundation (n.d.) states that children who are at the beginning stages of stuttering will show an increase in stuttering when they use long words or new vocabulary. This view suggests that this particular MS perhaps went through the same experience as he was acquiring language.

4.2.2.2 Analysis of data from the four examination tools

Temperature (Temp)

According to Mayo (2017), the average body temperature is 37.0˚C, but the normal body temperature can range between 36.1˚C-37.2˚C. However, the body temperature can vary depending on how active one is at the time of the day and generally older people have lower body temperature than younger ones (Mayo, 2017). Among the different kinds of thermometers; ear thermometer, temporal artery thermometers, oral thermometers, rectal thermometers and armpit thermometers, the armpit thermometer was selected for the current study because of comfort.

Nall (2018) declares that the body temperature vary depending on many factors including a person's age, gender, activity levels, time of the day; typically lower in the morning and higher in the late afternoon, food and fluid intake and the menstrual cycle for females. The body temperature varies depending on where on the body a person takes the measurement; the normal range for armpit thermometer for people between 11-65years is 35.2˚C-36.9˚C (Nall, 2018). The

working body temperature for the armpit thermometer in this study was 35.0˚C-39.0˚C. Out of 20 participants in this study, only 5 participants had lower temperatures than the working range.

The MS participant 1 had the temperature readings of 32.0˚C, 33.2˚C and 32.9˚C. MS participant 4 had 34.5˚C and 34.6˚C. The male non-stutterers participant 2 and 3 had 34.6˚C and 32.9˚C respectively. The female non-stutterer participant 5 had the temperature reading of 34.7˚C. These are the 5 participants that experienced lower temperature readings that are considered lower than the temperature readings of the current study.

The objective of the study was to identify and assess the breathing rates of stutterers and non-stutterers when they sing and speak. The temperature readings were employed due to the fact that the breathing rates are better assessed in relation to temperature, blood pressure, heart rate and oxygen saturation. As far as this data is concerned, there is no direct relationship between temperature and the breathing rates. The five participants who experienced unusual temperature readings had their temperatures lower than the temperature working range for this study. The expectation was to see whether lower or higher temperatures would lead to any change on the breathing rates.

However, there seems to be no significant pattern on this view because for MS participant 1, the temperature reading of 33.2˚C goes together with the higher breath rate of 21 per minute and the male non-stutterer participant 3 experienced the temperature reading of 32.9˚C that goes with the lower breath rate of 11 per minute. The other three participants who experienced lower temperature reading had their breath rates within the normal range of the breathing rate which is 12-20 per minute. Therefore, the two ‘abnormal’ breathing rates for the two participants cannot justify that there is a direct relationship between temperature and stuttering. Besides, both the

stutterers and non-stutterers experienced unusual temperature readings and at this juncture, it is difficult to associate breathing rate, temperature and stuttering.

Blood pressure (Bp)

According to Thibodeau and Patton (2010) blood pressure is the pressure of blood in the circulatory system. It exists in all blood vessels; highest in the arteries and lowest in the veins (Thibodeau and Patton, 2010). The normal value for blood pressure; the top value (systolic) is below 120 and the bottom (diastolic) is below 80 (Thibodeau and Patton, 2010). The pre-hypertension ranges from 120-139/80-89. Stage 1 hypertension ranges between 140-159/90-99 and stage 2 hypertension is 160 or more/-100 or more (Thibodeau and Patton, 2010). Weber (2019) on the contrary assert that the readings 130+/80+ (130 above/ 80 above) can be classified as "regular" high blood pressure and that the isolated systolic hypertension is a serious condition with the readings 140+/<90 (140 above/ less than 90). However, the working range for the present study is that of Thibodeau and Patton (2010) because it provides different ranges including of pre-hypertension, stage 1 hypertension and stage 2 hypertension.

Widmaier, Raff and Strang (2011) assert that values for both systolic and diastolic pressure average of about 10mmHg is less in females than in males at a given age. They further note that the difference between systolic pressure and diastolic pressure is called the pulse pressure. For instance, 120-80-40mmHg. However, there is a condition where the systolic blood pressure is higher than the diastolic blood pressure. The High Blood Pressure WebMD (2017) pronounce that when the systolic blood pressure is higher than 130 but the diastolic blood pressure is less than 80, that is called isolated systolic hypertension which is the most common type of high

blood pressure in older people. There are no noticeable signs of isolated systolic hypertension until it causes serious health problems (High Blood Pressure WebMD, 2017).

In the present data, there are participants who showed a single case of isolated systolic hypertension; MS participant 5 with 131/67, FS participant 3 with 134/66, male non-stutterers participant 2 and 5 with values 168/46 and 138/66 respectively. Even here with the Bp, the intention is to see if the Bp has a direct relationship with the breath rate so that stuttering can be linked. Of the four participants who experienced isolated systolic hypertension, 2 had lower breath rates while the other 2 had the normal breath rate. This data for isolated systolic hypertension does not really guarantee if there is a direct relationship between Bp and breath rate which as a result can impact on stuttering.

There are however values that the literature does not provide their cause or range but the systolic value is higher than the one provided for the normal range and still beyond the range for isolated systolic hypertension. This is the case with MS participants 1 with 128/74, 4 with 129/69 and 5 with 121/103 and 129/73, males non-stutterer participants 1 with 128/48, 2 with 125/73, 3 with 121/69, 4 with 128/69 and female non-stutter participant 4 with 126/73 and 129/69 and female non-stutterer with 125/71 respectively. Out of these 8 participants, the frequency of non-specific values was obtained for 11 times and 4 frequencies out of 11 with the systolic values ranging from 128-129. Specifically, participant 1 MS with 128/74, participant 4 MS 129/69, participant 5 MS 129/73 and participant 4 female non-stutterer 129/69 experienced the same breath rate of 15 per minute. Perhaps this constant number of breaths per minute can be associated with the systolic range provided. Hence, three MS and one female non-stutterer can be classified under this category though this caters for both stutterers and non-stutterers and as a result the finding cannot be generalised.

The frequency of 4 out of 11 with the systolic value ranges of 121-128, in particular MS participant 5 with 121/103, male non-stutterer participants 3 and 4 with 121/69 and 128/69 respectively and female non-stutterer participant 4 with 126/73 experienced lower breath rates than the normal ones. The frequencies of 3 out of 11 experienced the normal breathing rate with no particular pattern, these are participants 1 and 2 male non-stutterers and 4 female non-stutterer with the systolic values of 128/48, 125/73 and 125/71 respectively. These non-specified Bp readings were not noticed on FS as it affected only MS, male and female non-stutterers. Therefore, this cannot be said to have a direct relationship with stutterers because it affected both stutterers (MS) and non-stutterers.

Finally there are two participants with ranges that show pre-hypertension being MS participant 4; 125/81, 121/83 and 122/81 and the female non-stutterer participant 5; 126/90 and 128/89. For these two participants, the pre-hypertension ranges were present in the frequency of more than one per participant as a result the participants were advised to visit the medical doctor for proper examination. In relation to the current study, this finding cannot be interpreted to mean that it has a direct relationship with stuttering because it affected both MS and female non-stutterer. The Bp in general cannot be said to have a direct relationship with the breath rate where in return the breath rate would be associated with stuttering because the normal and 'abnormal' readings were identified in both stutterers and non-stutterers in all genders.

Pulse rate

According to Thibadeau and Patton (2010) a pulse is a valuable clinical sign that can provide information about the rate, strength and rhythmicity of the heartbeat. While it may be common knowledge that resting pulse rate (RPR) varies by age and gender, it can also vary by race (Hart,

2015). A normal (healthy) average by itself does not convey what a normal range is, the latter being of practical importance in the field (Hart, 2015). If the patient has a RPR of 72 beats per minute (bpm) and his reference mean is 71bpm, without knowledge of what the normal range is around the mean, the clinician does not know if his patient's 72bpm measurement is higher than a normal range (Hart, 2015). On the other hand, blood pressure has advanced the measurement to a point where normal ranges are available where normal blood pressure range is <120/<80 and pre-hypertension is 120-139/80-89 (Hart, 2015). Hart (2015) imply that the pulse rate on its own is non-specific because there is no advanced research to provide the normal and abnormal rages for it.

Gukulnath and Thandeeswaren (2018) emphasise that every organ in the body needs oxygen to work effectively. They indicate that oxygen is supplied when the blood passes through each part of the body by means of arteries. However, actors like smoking, alcohol, stress, over salt in the diet may cause the artery wall to get narrower, as a result, the blood cannot pass through the vital organs in the body and it cannot work properly (Gukulnath and Thandeeswaren, 2018).

MacGill (2017) declares that the pulse is often confused with the heart rate but it refers to how many times per minute the arteries expand and contract in response to the pumping action of the heart. He further notes that the pulse rate is exactly equal to the heartbeat as the contractions of the heart cause the increases in blood pressure in the arteries that lead to a noticeable pulse. He concludes that taking the pulse is therefore a direct measure of the heart rate. He clarifies that the heart rate is fast during exercise, emotional responses and being frightened or surprised automatically releases adrenaline to make the heart rate faster where the body is being prepared to use more oxygen and energy to escape or confront a potential danger.

The normal resting heart rate for children at 10 years and adults as proposed by MacGill (2017) ranges between 60-100 beats per minute. The current study therefore analysed data based on MacGill's (2017) view of the heart rate range. In the present study, three MS experienced the lower heart rates than the one provided on the heart rate range; participant 3 had 59 beats on the second trial before the activities, participant 4 had 53 beats on the first trial before the activities and 51 and 53 beats after the activities and lastly participant 5 had 59 beats on the second trial before the activities and 59 beats on the first trial of the activities.

Four of the male non-stutterers experienced 'abnormal' heart rate in the following manner: participant 1 with 48 beats on the first trial before the activities which falls below the provided range; participants 2, 3 and 4 experienced higher beats than the provided range. Precisely, participant 2 experienced 110 beats on the first trial before activities; participant 3 experienced 110 and 106 beats after the activities and participant 4 experienced 108 beats on the first trial of the activities. Two of the female non-stutterers experienced higher beats than the one provided on the normal range; participant 3 experiencing 109 beats on the first trial before activities, 104 and 101 after the activities while participant 4 experienced 101 and 101 before the activities and 101 on the second trial after the activities. Even with the pulse rate there seems not to be any possible pattern associating pulse, breathe rate and stuttering. Where lower and higher pulse readings were identified, there is no direct pattern that could say the pulse affected the breath in a certain way because the normal and 'abnormal' breath rates were identified across all the participants. Therefore a general identification cannot be made.

Breathe rate (Br)

Pietro (2019) notes that respiratory rate change is based on many health and activity factors and that the normal respiratory rates also differ in adults and children. The respiratory rate is the number of breaths someone takes every minute and is one of the main vital signs along with bp, pulse and temperature (Pietro, 2019). He further indicates that normal respiratory rate plays a critical role in keeping the balance of oxygen and carbon-dioxide even. The normal respiratory rate for healthy adults is between 12-20 bpm (breathe per minute) (Pietro, 2019). The breath rate range provided by Pietro (2019) is similar to that of Drost *et.al* (2013) which is the working range for the current study. Breaths beyond this range were regarded low and the breaths above this range were regarded high in the current study.

In the current study, 16 of the 20 participants experienced low and high breathe rates. The MS participants who experienced the 'abnormal' breathing rates were participant 1 with 21bpm after singing and speaking activities, participant 2 with 33 and 35 during speaking session, participant 3 during speaking, participant 4 with 9 and 9 at the first trial during rest and at the second trial in speaking session and participant 5 with 10, 9, 9, 9 and 8 experienced in the speaking activity, before the activities and on the second trial after the activities. All of the FS experienced the 'abnormal' breaths during speaking session though at the frequency of one except for participant 3 who experienced them in the two trials of speaking session where she had 11 and 8bpms. The FS participant 1 had 21, participant 2 had 8 and participant 4 with 24.

For the FS, there is a pattern in that the 'abnormal' breaths were only experienced during speaking. As for the MS, the pattern of 'abnormal' breaths was identified in different environments with the exception that 4 out of 5 participants experienced the 'abnormal' breaths during speaking session. The pattern for the stutterers is that in the 18 trials where the breathe rate was assessed, only 1 out of 18 trials had 'abnormal' breathe rate. This involves the case of

FS participant 4 where in the first trial of singing, 8bpm was identified; while for the rest, the normal breathes were identified during singing. Perhaps this identification has something to do with the reduction of stuttering observed during singing.

With the male non-stutterers, four of the five (80%) experienced 'abnormal' breaths with reference to participant 2 with 11 breaths at the first trial at rest and 25 breaths during speaking; participant 3 with 11 and 9 while at rest, 25 at first trial during speaking and 30 at first trial after speaking and singing; participant 4 with 14 and 21 while at rest; and participant 5 with 31 at the last trial at rest and 9 at the last trial after singing and speaking. There is however no significant pattern for the male non-stutterers, each pattern can therefore be attributed to ones record of temperature, Bp and pulse rate, and as far as this data is concerned, there is no direct relationship between temperature, Bp, pulse rate and breathe rate that can be linked to stuttering in general.

The female non-stutterers also experienced 'abnormal' breaths particularly with reference to participant 2 with 21 at the second trial of speaking and 11 for first trial after singing and speaking; participant 3 with 10 during speaking and lastly participant 4 with 10 and 10 at the first and second trials at rest. A total number of 12 of the 16 participants who experienced 'abnormal' breathing rates were noticed during speaking session. This can suitably tally with the report from Southampton University Hospital (2017) that coordinating breathing while talking is a common problem in breathing pattern disorders because speech interferes with the background rhythm of breathing.

The current data on Bp responds to the research questions of this study in that stutterers and non-stutterers use different breathing rates. Considering the observation that stutterers stutter less when singing, the breathing rates can be blamed for the occurrence of stuttering during speaking

because of the difference in breathing rates during singing and speaking. This data refutes the first hypothesis in that stutterers and non-stutterers use different breathing rates during speaking.

4.3 Findings

Initially, the MS were more interested to participate in the study than the FS. This is shown on the MS participation in the questionnaire section. As much as some did not have time to do the second part of the data collection, they were however present to complete the questionnaires. The MS participated in the ratio of 7:4 than the FS on the questionnaire section. There are more MS than FS in NUL campus because all the participants were from the NUL campus being either students or staff members. The MS had related answers in relation to what triggers their stuttering more. As a result, based on their responses, anxiety and anger seem to be the major elements that trigger their stuttering more. Perhaps the first language is problematic to stutterers. This is acquired from one MS who said he stutters more when speaking Sesotho.

In all the stutterers who participated, only one participant did not acquire stuttering from genetic influence. This implies that more stutterers acquired stuttering as a result of a genetic influence. Another finding of this study is that perhaps consonants are the ones that stutterers stutter on based on the responses to question 6 of the questionnaire in which all the participants pointed out certain consonants but not vowels. There is however no exact pattern on the sounds and words that stutterers stutter on except for a few exclusions where there is a possible pattern such as the case of sound patterns of /-str-/ and /-lk-/. The fact that stutterers identified the environments that make them stutter more and less, can be used as a self-therapy tool to prepare themselves in advance to such environments by possibly identifying the things that they do when they stutter more or less.

On the second part of data collection, only one female non-stutterer did not encounter any 'abnormal' readings based on the proposed ranges. This is the case of participant 1 female non-stutterer. The FS in general had good readings compared to MS, female non-stutterers and male non-stutterer. The FS did not have any 'abnormal' readings in relation to temperature and pulse rate. Their results for these two components all fell on the normal ranges. As compared to MS, each participant had an 'abnormal' readings on either temperature, Bp, pulse or Br in the frequency of minimum two and maximum of ten. The FS in general had good readings except for the breathing rate readings where two participants had breaths lower than the normal range and two participants experienced breaths higher than the normal range. Only one FS participant who experienced isolated systolic hypertension and as for the rest, their Bp readings were right within the normal range.

The male non-stutterers experienced higher breathing rates in the fraction of four out of five for at least once except for participant 1. Only one out of 5 male non-stutterer participant experienced lower temperature beyond the proposed range and as for the rest, the temperature readings were all good. All the male non-stutterers experienced 'abnormal' Bp ranges being either the isolated systolic hypertension or the non-specified range of values higher than 120 and below 80. The pulse rate for the male non-stutterer had no sequence because 1 participant did not experience any 'abnormal' reading and 1 participant experienced the pulse reading below the normal range and 2 participants experienced the pulse readings above the proposed range.

Of the female non-stutterers, only 1 participant had the temperature readings less than the proposed range while the readings for the others were all good. Two participants experienced the 'abnormal' Bp readings with one participant experiencing the readings that fall on the non-specified range and the other with readings that displayed pre-hypertension and for the other

participants, the readings were all good. As for the pulse rate, 2 participants presented readings higher than the normal range and for other participants the readings were all good. Three participants displayed ‘abnormal’ readings of the breathing rates with readings representing both high and low breaths based on the proposed range.

4.4 Conclusion

The first two objectives of the study were met in that the breath rates were identified and assessed during speaking and singing. The findings of this study will be used to add on the already existing literature that there is reduction of stuttering during singing with the breath rate readings falling on the normal range for both groups of stutterers. As an extra task considered when assessing the breathing rates as suggested by Pietro (2019) the temperature, Bp and pulse were considered. However the three extra aspects did not present any direct relationship for the breath rate as a result stuttering could not be involved because the irregular and ‘abnormal’ readings were identified in all groups of the participants.

The finding was that where ‘abnormal’ readings were identified on any aspect, the frequency was more than one with other aspects being associated though the relationship could not be spotted. There was no single ‘abnormal’ reading that was identified once on any participant. The ‘abnormal readings were identified several times with either the same aspect being identified twice or more. The stutterers who indicated that they had problems uttering certain sounds all identified consonants not the vowels. Therefore the consonants can be said to be the ones difficult for stutterers to utter. Generally, the FS experienced normal readings concerning temperature, pulse and Bp with the exception of the breathing rates where each participant experienced ‘abnormal’ readings from the frequency of one.

CHAPTER FIVE: CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter concludes the entire research by reminding the reader of what each chapter focused on as well as the salient findings of the study. In order to improve and explore other angles, the limitations and recommendations are also provided. Like the nature of the study, the relationship among variables is also important and the impact that they have is noted. This comparative study helped to identify if the stutterers and non-stutterers use the same breathing technique, how the breathing technique can be improved and if the breathing rates can be blamed for the occurrence of stuttering during speaking.

5.2 Conclusion

The first chapter of this study is generally the introduction of the entire study containing the background to the study which noted the status of stuttering in Africa. In the background of stuttering, the origins and myths of stuttering were also included in relation to which cultures and races are affected by stuttering. The definition of stuttering by different authors was also provided together with the relationship between stuttering and language. The singing anatomy and breathing anatomy were included in order to find the link in stuttering, singing, breathing and speaking. This was influenced by the observation that there is 'no stuttering' during singing. As a result the song was included in this study to see if the reduction of stuttering observed during singing is caused by the breathing rates or not. The chapter equally provided the problem statement, research questions, hypotheses, objectives of the study, justification of the study, significance of the study, scope and delimitation.

The second chapter basically focused on the literature review and theoretical framework of the study, as well as the theories of speech production and stuttering that were related to the current study. The stuttering disorder was also expanded in relation to the causes of stuttering, types of stuttering and characteristics of stuttering in order to understand the disorder better. In order to find the connection in the four areas described in chapter one: singing, speaking, breathing and stuttering, their relationship was also considered for a deeper comprehension of stuttering and breathing. The challenges of stuttering were addressed considering psychological effects of the individual and challenges faced by stutterers in education. For a linguistics student like the current researcher, the relationship between linguistic aspects of stuttering was also provided in order to understand the nature of stuttering and linguistics. As a self-therapy to stutterers, the cures and therapies of stuttering were also provided including the advanced drugs and machines.

The third chapter, the methodology, revealed how data was collected and analysed, the approach used in the study and the design followed by the study. The current study followed mixed method approach in the correlational nature of the study, where the convergent parallel design was applied. The population selected was clearly stated in this chapter being both staff members and students of NUL. Three sampling techniques were employed namely purposeful, self-selection and snowball sampling. The ethical considerations were cautiously addressed including among others; anonymity, participants' freedom to quit anytime they feel uncomfortable, no physical or psychological pain on the participants and no impact on both academic and personal lives of the participants.

The last two chapters, chapter four and five, related how the current study answered the problem statement, research questions, hypotheses and research objectives. The pioneers of the breathing technique that it could be used to reduce stuttering being Azrin and Nunn (1974) did not

recommend the appropriate range for stutterers. Therefore, the problem statement for the current research was to bridge the gap by introducing the breathing rate range for stutterers in order to eliminate stuttering during speaking. This was possible by assessing the difference in breathing rates for stutterers and non-stutterers during singing and speaking. During singing, the stutterers used the breathing rates of between 8-18bpm with the minimum number identified in women and the highest in men while the non-stutterers ranged from 12-21bpm with the minimum number identified in both males and females. In speaking, the FS and MS breathes ranged from 8-35bpm while for non-stutterers they ranged from 12-25bpm. Therefore, in order to reduce stuttering, the study suggests that stutterers should speak within the breathe rate of 12-18bpm for the MS and 8-14bpm for the FS.

The FS in general had different answers as to what triggers their stuttering while the MS responses were pointing out to the issue of anxiety and anger. As a result, in the present study, the leading factors for the MS triggering stuttering are anxiety and anger while the triggering factors in females cannot be generalised. Meanwhile, 90% of the stutterers denoted that they acquired stuttering as a result of genetic impact. Therefore it can be concluded that stuttering mainly spread through genetic influence.

5.3 Limitations

It was very easy to find MS to participate in the questionnaire type of data collection but difficult to have the same number of people to participate in the second type of data collection. This was caused by the bad timing, as stipulated earlier, the data for this study was collected during the examination period of NUL students and as a result, some MS participants were not available to

provide the data for temperature, blood pressure, pulse rate and for the breath frequency. This therefore suggests why only five male stutterers participated for the second data collection.

The initial plan was to collect data and assess the breathing rates in relation to heart rate, blood pressure, temperature and oxygen saturation for better results. However, the oxygen saturation content procedure was omitted in the current study due to limited time and resources. The time was limited in a way that contacting different hospitals, pharmacies and clinics inquiring if they had a pulse oximeter that would enable the readings for oxygen saturation would require a lot of time to do so. On the other hand, the NUL Health Science department and NUL Clinic did not have such a device and even the pharmacy where the blood pressure monitor was taken did not have it, therefore, limited resources were the issue. The participants volunteered in the study and as a result, the researcher could not have more people participating as expected because the participants had to come to the researcher through willingness. This impacted the study in that the possible number of stutterers around NUL campus could be far more than those who participated and as a result the finding cannot be generalised. However, the results obtained from the current study can give a direction in the breathing rates of stutterers.

5.4 Recommendations

For future researchers interested in assessing the breathing rates of stutterers, the frequency to monitor the breath rates according to the current researcher would be beneficial and reliable if it is five times per session because the current researcher beliefs that the pattern of each stutterer's breathe can be traced and identified. This can help the researchers when they have clients who stutter as to suggest the appropriate breath rate range for them when they want to eliminate their stuttering issue when talking. Perhaps for a possible number of stutterers to be achieved in NUL

campus, the duration for call for stutterers to participate in the study can be extended to at least five months which is half-year for NUL academic calendar so the message can spread for as much as possible with of course the involvement of internet messaging facilities. When monitoring breath rates, perhaps the temperature, pulse and blood pressure could also be monitored during speaking and singing to identify the difference in all the four aspects compared to when the participants were at rest and after the activities, so as to see if there would be any difference.

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APPENDIX 1

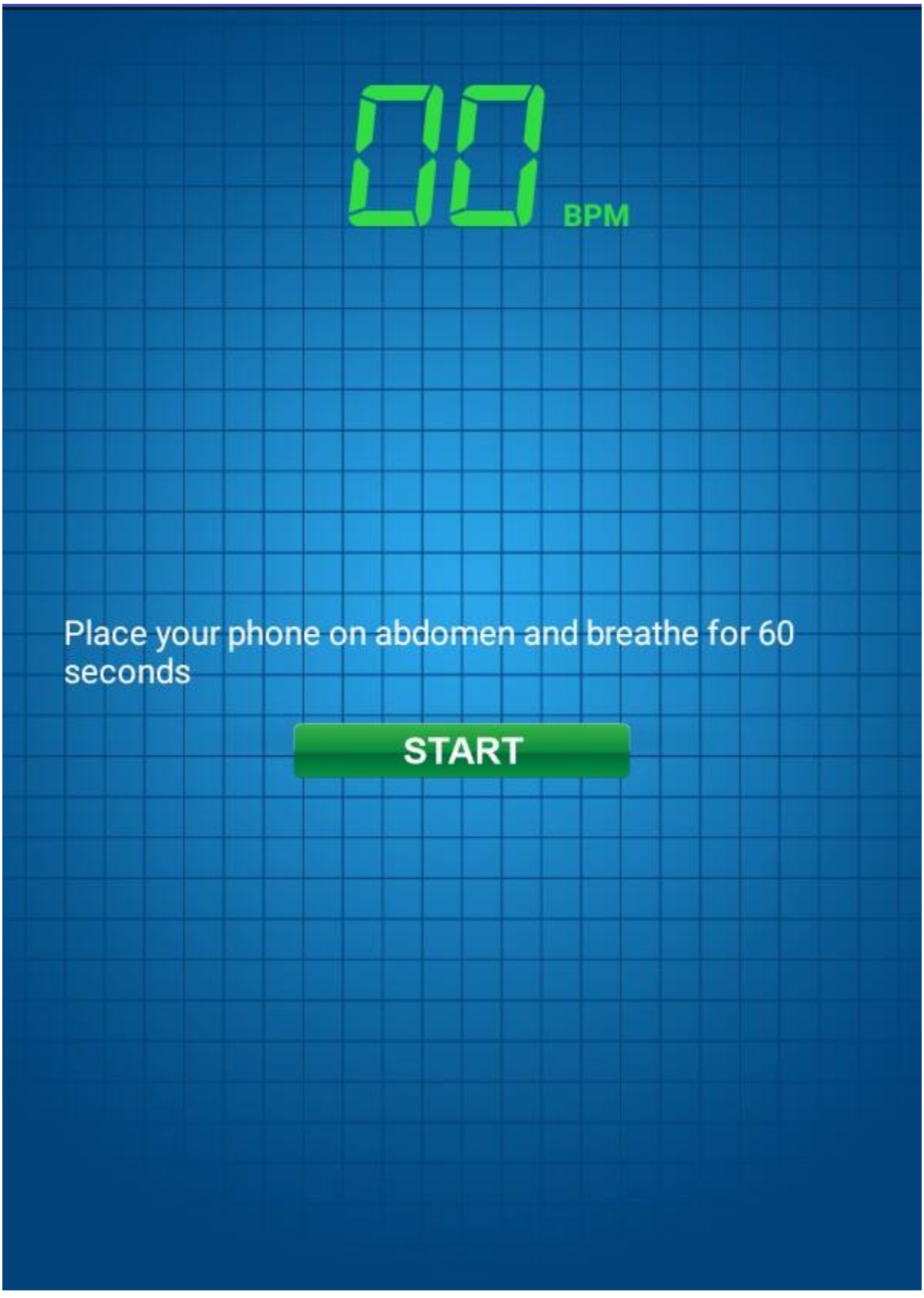
QUESTIONNAIRE

1. GENDER: FEMALE MALE OTHER (circle around)
2. Which environment makes you stutter more or under which circumstances do you stutter more?.....
3. Which environment makes you stutter less or under which circumstances do you stutter less?.....
4. What age were you when you discovered you have stuttering?.....
5. Are there any members in your family that stutter? Yes No (circle around)
6. Are there any particular sounds, words and phrases that you stutter on? Yes No, if yes indicate them…….

APPENDIX 2

TOOLS OF THE STUDY

A: BREATH COUNTER



B: Thermometer

C: Blood Pressure Monitor

APPENDIX 3

INFORMED CONSENT FORM

TITLE: A COMPARATIVE ANALYSIS OF BREATHING RATES AND PATTERNS OF STUTTURERS AND NON-STUTTERERS

RESEARCHER: MAKY LETSIE (MA STUDENT, FACULTY OF HUMANITIES, ENGLISH DEPARTMENT, NUL)

The current therapy for stuttering according to the literature is the regulated breathing rate. The purpose of the present study however, is to see if there is a difference in the breathing rates of stutterers (persistent developmental stutterers) and non-stutterers and to add knowledge to the already existing literature about the nature of stuttering and therapies.

For data collection, the breathing rates will be measured in relation to the heart rate, blood pressure, temperature and oxygen saturation for accurate and fair results. Data will be collected during four activities: when the subject is at rest, singing, speaking and after the activities.

The equipment for data collection is the clinical thermometer, oxygen saturation monitor, digital blood pressure monitor and a breath counter application. The thermometer will mainly be used to measure temperature; oxygen saturation monitor for oxygen saturation; breath counter to assess the breathing rates while the subject is at rest, singing, speaking and after the activities; the digital blood pressure monitor for pulse and blood pressure readings. As far as all these instruments are concerned, there is no physical pain. If the subjects feel uncomfortable, they are urged to inform the researcher as soon as possible.

Anonymity of the subjects will be maintained in a way that only the researcher will know the subjects because during submission and analysis of data, the numbering codes will be used to

refer to the subjects. In order to maintain confidentiality of the data, untranscribed data will be stored in the personal files of the researcher for a maximum of six months.

The study has been approved by the English department at the National University of Lesotho, Faculty of Humanities Board.

I declare that I have discussed the above points with the subject verbally and in more details. I truly assert that participation in this study is voluntary, that it has nothing to do with their academic or personal lives and that the anonymity and confidentiality of subjects and data respectively will be maintained. The subjects are free to ask questions at any point and the questions will be fairly answered. Finally the subjects are free to quit at any time they feel discomfort or distrust without any scrutiny or penalty.

Researcher:……Date……

I understand that my participation is voluntary and that I may refuse to participate or withdraw any time without penalty or scrutiny.

I therefore freely consent to take part in this research project.

Signature of subject……Date……