THERAPEUTIC MODULE FOR REHABILITATION OF ADULTS WITH STUTTERING: ASSISTIVE STUTTERING INTERFACE- ADULTS

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A Dissertation Submitted in Part Fulfillment of Degree of

Master of Science (Speech-Language Pathology)

University of Mysore, Mysuru

ALL INDIA INSTITUTE OF SPEECH AND HEARING

MANASAGANGOTHRI

MYSURU -570006

July 2020

DEDICATED TO MY

MITIK, PEPSI, TOMMY,

SAANDWITCH

AND

MY MOTHER “EARTH”

Certificate

This is to certify that this dissertation entitled **"Therapeutic module for rehabilitation of adults with stuttering: Assistive Stuttering Interface- Adults"** is a bonafide work submitted in part fulfillment for the degree of Master of Science (Speech-Language Pathology) by the student holding Registration Number 18SLP006. This has been carried out under the guidance of a faculty member of this institute and has not been submitted earlier to any other University for the award of any other Diploma or Degree.

Mysuru

July, 2020

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Certificate

This is to certify that this dissertation entitled **"Therapeutic module for rehabilitation of adults with stuttering: Assistive Stuttering Interface- Adults"** has been carried out under my supervision and guidance. It is also certified that this dissertation has not been submitted earlier to any other University for the award of any other Diploma or Degree.

Mysuru

July, 2020

Guide

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Declaration

This is to certify that this dissertation entitled "**Therapeutic module for rehabilitation of adults with stuttering: Assistive Stuttering Interface- Adults**" is the result of my own study under the guidance of Dr. Anjana B. Ram, Assistant Professor, Department of Speech-Language Pathology, All India Institute of Speech and Hearing, Mysuru, and has not been submitted earlier to any other University for the award of any other Diploma or Degree.

Mysuru **Register No.: 18SLP006**

July, 2020

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It has been an extraordinary opportunity to gain humongous experience during this project, including the knowledge I gained regarding various concepts, research designs and rules, loopholes in the field such as aspects still left unexplored, coding- the programming language which is the next-generation language, the need of present practitioners to use the technology as an asset and so much more.

Working on this project has given me so much in return, that I will embrace it forever within me. The rollercoaster ride of planning and completing my first ever project work has been the best till now. I and my dissertation partner, Parnika were determined to do something modish, advanced, futuristic and avant-garde. Our guide Anjana ma'am, so broad minded, talented, and creative, shared the same angle of thought with us. She suggested tremendous options for us to swing our thoughts and plans into reality.

I still remember my first discussion with Anjana ma'am and Parnika. We exchanged so many ideas regarding the practice of telerehabilitation, and the development of computer and mobile applications for the field of Fluency Disorders. Initially, we planned for a therapeutic mobile phone app which would assist people with stuttering to practice therapy techniques in various real-life situations under a speech-language pathologist's guidance. Both of us started exploring the internet to know more about computer and mobile apps dedicated to stuttering therapy to gain some knowledge as to how they work, what all

aspects have been considered to develop them, what are the limitations and future directions which probably we could use to design our app.

We, head over heels to somehow develop the useful tool, learnt that we would need someone to develop the app, as we lacked the knowledge concerning the language of computer. We contacted one of the mobile app developers and were not satisfied by the response. So we started intensifying our Plan-B, which was a computer application.

Regarding this, we met Karthik sir, the sole Speech Technologist of our institute. We had multiple sessions of discussion as to what, how, when, to develop the program. He gave his word that he would help us to transfer our imagination into a computer application. Then, we had finally decided as to what our project would be. It was an application to be used by clinicians at AIISH to provide therapy to adults and children with stuttering.

Then, was the time to propose our plan to the dissertation committee, in front of other staff members and our classmates. Suggestions showered on us during the research proposal presentation. Most of the staff members and students liked the thought of developing a therapeutic software program, but also warned us regarding the time constraints and dependency on a third person. We compiled all the suggestions including to develop a module rather than a software program, and worked on implementing those and revising our research proposal.

The product of revision was our final dissertation topic, to develop a computer-based module. I and Parnika started compiling information related to stuttering in adults and children, respectively. We had constant discussions with ma'am as to what would a young learning clinician and a client expect and need from the module. Slowly, we collated all the information obtained from various sources, which was further scrutinized and validated by our guide.

And then, we encountered the news of the unexpected pandemic, THE CORONA VIRUS. Alas!! We had to stop attending the classes and the clinics. Our college announced halt on academic activities on the 16th of March, 2020. Our last semester of the ever last college-year was at halt. Hope was the only feeling to fulfill our desires of enjoying the last few days of college life. But, never was it recommenced. The theory classes were conducted online via Zoom, so as to complete and wind up with our only three courses of the last semester. All of us were expecting a very soon end to this, but somewhere the premonition took place. LOCKDOWN and QUARANTINE were the most frequently spoken words by everyone, after CORONA. Nobody spoke anything, but corona and the havoc it created. This was the once in a millennium experience for all of us. The lockdown extended till the month of May, and was slowly eased from the June. But schools and colleges never reopened.

We stayed connected via video and voice calls. We started exploring the other brighter sides of life and ourselves. We started developing every basic skill that an individual would require for his/her livelihood. We shaped our skills in dancing, singing, drawing, cooking, exercising, gardening, and many more.

Cooking and baking were trending at that time, and not to forget the mandala art too. It was a refreshing break along with a tensed scenario of a pandemic disease which had no medicine for cure, and which had affected a crore and killed lakhs till date.

The pandemic affected our lives in every way possible. Our batch, the BRAINIACS, faced a lot of issues locked at a place, unable to complete the collection of proposed amount of data for the dissertation. This led to the postponement of our examination, dissertation submission and viva dates. Every student was under a lot of stress, especially the ones who stayed in hostels. My friends used to experience panic attacks out of nowhere. Their mental peace and health was disturbed. Everybody tried supporting each other up to their potential. They wanted to go home, but it was impossible. Everyone had to follow "stay safe, and stay where you are".

By the end of April, our director noticed us about her idea to provide clinical services via telemode. As the whole institute was closed, rehabilitation services were dismissed, and clients were facing issues as to what to do next. Most of the students accepted to provide therapy via Zoom and WhatsApp. This was one of the best examples for the need and use of telerehabilitation in our generation, and provided support to our project.

After weeks of receiving no updates, we were noticed to present a progress report regarding the dissertation on the 13th of May, 2020. As a result of this presentation, the committee again suggested to modify our objectives,

because of our inability to progress due to the lockdown. We utilized this ample time during the lockdown to fetch more information for the module.

On the day of 11th June, 2020 we finally received a notification from the college regarding the submission of our dissertations. It was scheduled on the 10th of July, 2020. All of us accelerated our work and continued writing reports.

Now, the institute was open only for the staff members. Then, the organized information was given to Karthik sir to design the module. En route, numerous modifications were made and incorporated into the computerized version of the module. We cannot be less grateful to sir for tolerating and considering our demands, and working on it constantly, in spite of having busy schedules.

We ultimately developed and submitted the module on the 10th of July, 2020.

Finally after penning down my experience, I would love to address all those who directly and indirectly made my college life as the one to be cherished.

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The one reading this dissertation*, Hey! I appreciate you going through everything in detail. This module is developed for the clinical training and utility. I hope you use it sincerely and deliver your best to the clients.*

At this note, I would want to thank and end my words of acknowledgement.

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Chapter 1

Introduction

Stuttering is a fluency disorder that interrupts the smooth forward flow of speech. It can be a developmental or an acquired disorder, with repetitions, prolongations, and blocks being the hallmark (Guitar, 2014).

As Riper (1982) stated, "stuttering occurs when the forward flow of speech is interrupted by a motorically disrupted sound, syllable, or word, or by the speaker's reactions thereto." According to him, in stuttering, speech is disrupted and produced improperly in time, including the reaction towards self-stuttering. There are deviancies in the processes of speech planning, programming, and execution.

The core stuttering behaviors, including the repetitions, prolongations, and blocks, can co-occur with secondary behaviors, including escape and (Yairi & Ambrose, 1999) avoidance behaviors, and tension. Negative self-perception and stigma associated with one's speech are also significantly present in persons who stutter. In 20-25% of the cases, stuttering persists into adulthood (Yairi & Ambrose, 1999; Smith & Weber, 2017).

Stuttering is a multi-faceted issue to the person with stuttering him/herself and others with whom he/she interacts. A complex association between the motor disruption during stuttering and the disorder's emotional attributes affects the further variations in the speech behavior. Ultimately, there is a severe disturbance in the individual's social functioning, leading to various imbalances in life (Peters et al., 1991).

Speech-Language Pathologists (SLPs) face various challenges while providing rehabilitation services to persons with communication disorders, including fair and impartial access to the services, and provision of suitable intervention in varying social and economic contexts. Majorly, it is because the disorder has a remarkable effect on the person's quality of life and the family.

Speech and language disorders require long-term rehabilitation services. Persons who cannot travel to the rehabilitation centers due to various constraints related to the disability, travel distance, or any other reason discontinue availing the services. Thus, there is a crucial requirement of telepractice to deliver services adequately using information and communication technology modes. With advanced science and technology, computerized therapeutic materials for rehabilitation purposes will be the new generation tool.

In telepractice, information and communication technology is utilized for service dispensing via modes other than in-person delivery (Lowe et al., 2013). It has a high potential to provide services to persons facing barriers with respect to geographical, time, and sociocultural aspects.

Telerehabilitation seems apt to deliver services to persons who are geographically remote and physically challenged. It utilizes the technology of videoconferencing and computer-based activities. This particular form of service is flexible to be delivered in a home setting and a local community setting. It can facilitate maintenance and generalization of treatment outcomes in various everyday situations of a person and regularly monitor communication behaviors.

Various speech and language disorders in adults, including stuttering, laryngectomy, dysphagia, voice disorders, speech, and language disorders in children, have been intervened using image-based telerehabilitation applications.

Telerehabilitation needs well-developed applications, software, and other computer-based therapeutic tools to become an integral part of SLP practice (Theodoros, 2008). It has to be a cost-benefit and cost-effective tool, and further practitioners need to know these for service delivery in the field.

Need for the study

To provide management for persons with stuttering requires enormous clinical experience and skill training. As both overt and covert behaviors characterize the disorder, it is essential to cater to both aspects while providing therapy. With the existing therapeutic materials and aids in clinical services, the usage of those materials has been minimal.

In order to provide a comprehensive management strategy for persons with stuttering, it is crucial to know the various treatment procedures, to be able to explain and demonstrate various techniques, to be able to justify the rationale behind the usage of each technique, to be able to choose and practice different activities at various phases and also, most importantly, to document the progress.

The use of telepractice to provide rehabilitation for persons with stuttering has not been explored much. Using a computer-based module, for providing therapeutic services is beneficial for both professionals as well as clients. The professionals can use the module to provide information regarding the mechanism of fluent speech, how dysfluent speech is different from fluent speech and orientation

regarding the treatment procedures. This module can also further help the clinician demonstrate the techniques, provide feedback to the clients in real-time, and document the progress. The clients will be given better opportunities for gaining insight into various aspects of stuttering, know more about the disorder, to be able to practice the techniques and to self-monitor.

Hence the present study is planned to develop a computer-based module that provides facilities such as an overview of stuttering, demonstration of various techniques, feedback system, and documentation of progress.

Aim of the study

The current research aims to develop a computer-based module for the rehabilitation of adults with stuttering (AWS).

Objectives of the study

1. To develop a computer-based module that provides various facilities, useful in the management of AWS.
2. To orient clinical practitioners of SLP regarding the use of telepractice in the rehabilitation of AWS.

Chapter 2

Review of literature

2.1. Definition

The term “stuttering” (Wingate, 1964) definition:

I. “(a) Disruption in the fluency of verbal expression, which is (b) characterized by involuntary, audible or silent, repetitions or prolongations in the utterance of short speech elements, namely: sounds, syllables, and words of one syllable. These disruptions (c) usually occur frequently or are marked in character and (d) are not readily controllable.”

II. “Sometimes the disruptions are (e) accompanied by accessory activities involving the speech apparatus, related or unrelated body structures, or stereotyped speech utterances. These activities give the appearance of being speech-related struggle.”

III. “Also, there are not infrequently (f) indications or report of the presence of an emotional state, ranging from a general condition of “excitement” or “tension” to more specific emotions of a negative nature such as fear, embarrassment, irritation, or the like. (g) The immediate source of stuttering is some incoordination expressed in the peripheral speech mechanism; the ultimate cause is presently unknown and may be complex or compound.”

2.2. Course of stuttering

Developmental stuttering mostly arises in the preschool years. Younger children stutter more freely and do not usually exhibit secondary behaviors. Children

gain awareness regarding their speech being different from others due to the people's reactions in their environment. Various factors related to the environment and children lead to the establishment of struggle, which results in the elevation of anxiety, disruption of breath control, and fixation of postures associated with a chronic stutter (Guitar, 2014). The development of secondary speech and non-speech behaviors occurs due to the psychological changes associated with stuttering.

Most of the children outgrow developmental stuttering with age. Early intervention is highly effective for early childhood stuttering. Deborah J. et al. (1997) reported that around 70% of SLPs were successful in treating preschool children who stutter. It often results in satisfactory and long-term outcomes in early childhood stuttering intervention with minimal treatment time (Onslow & Packman, 1999).

However, for some, stuttering becomes a chronic condition that persists into adulthood. As they reach their adolescence, the severity of the stuttering disorder reaches its peak. It becomes challenging to manage due to its high resistance to change (Riper, 1982; Bothe, 2004). During adolescence, a person is more conscious of his/her speech. There is heightened self-consciousness, increased self-evaluation, and higher sensitivity to other's opinions. Tension, escape, and avoidance behaviors are firmly established. Over many years, frustration, guilt, fear, and hostility get built up due to the inability to speak like others and many bad experiences with listeners' reactions. The person starts believing that people are disgusted by his/her stuttering. Stuttering can be alleviated but cannot be cured completely when it persists for 10 or more years (Cooper, 1987).

The severity of stuttering usually decreases in later ages during adulthood, as

self-consciousness reduces and self-acceptance increases. Also, by trial and error, the person establishes his/her ways to cope with the stuttering problem. Louis (2001) presented various stories of people dealing with stuttering in their ways, by changing the pattern of speech, reducing the avoidance behavior, and increasing self-confidence by interacting with others. Further, a person might experience good days and bad days with stuttering. Stuttering is a heterogeneous disorder and can vary from time to time. Emotions also play a significant role in experiencing good and bad days.

Almost one-third of the cases will experience relapse within 6-12 months post-treatment or an unsatisfactory improvement (Hancock et al., 1998; Boberg & Kully, 1994). Constant treatment duration, long-term professional and economic resources are crucial for the treatment of persistent stuttering.

2.3. Characteristics of stuttering in adults

Majorly, the features observed in the AWS are studied as core and secondary behaviors. Van Riper (1982) described repetitions, prolongations, and blocks as core behaviors involuntary to the person who stutters and reactions to these, results in secondary behaviors. They either try to quickly or entirely end the dysfluencies or avoid them altogether. These reactions seldom begin as random struggles, but later turn in to learned patterns. These secondary behaviors are classified as escape and avoidance behaviors. Escape behaviors are when a person tries to finish a word and get out of the stuttering moment. These behaviors can be observed as facial grimaces, head nods, interjections, etc. Avoidance behaviors are those where a person anticipates stuttering and tries to avoid the stutter by pausing, omitting, or substituting the word to be spoken (Guitar, 2014).

2.3.1. Core behaviors

Core behaviors of stuttering in older teens and adults include repetitions and prolongations, but advanced stuttering is often distinct in the struggle and tension of blocks. Blocks are longer and more struggled, associated with tremor in adults than in school-age children. Tremors during blocks are usually seen in persons stuttering for many years, and those who have a strong emotional connection with their fluency disorder (Guitar, 2014). Repetitions and blocks are the most often observed dysfluencies in AWS.

- Repetitions include a syllable, sound, word, or phrase being repeated multiple times (e.g., "li-li-li-like this"). They are more tensed, with a rapid and irregular tempo, mixed with fixed articulatory postures of tense blocks.
- Prolongations are dysfluencies where a person holds onto a sound for an extended duration (e.g., "llllike this").
- Blocks occur when a sound is not produced, followed by a "burst" of tension released as the speaker vocalizes (e.g., "----like this"). They may occur at the respiratory, laryngeal, or articulatory level.

The dysfluency types may be grouped as Stuttering-Like Dysfluencies, including part-word repetitions**,** single-syllable word repetition, dysrhythmic phonation, etc and Other Dysfluencies including phrase repetitions, interjections, revisions, etc (Yairi & Ambrose, 1992).

2.3.2. Secondary behaviors

AWS try to avoid some words and situations. Secondary behaviors are coping mechanisms that a person uses to quickly end one's stuttering or avoid them.

These gradually become well-learned patterns/strategies exhibited by the person who stutters. These can vary with age and severity of stuttering. Each person's secondary behavior may be different based on his/her individual preferences in coping with stuttering.

Some of the secondary behaviors may be pursing lips, raising eyebrows, clicking tongue, taking a deep breath before speaking, moving hands, tapping foot/feet, silently rehearsing, using interjections, pretending to think, omitting and/or substituting words, speaking in a different manner than usual, etc (Vanryckeghem et al., 2004). Nostril flaring, sudden loss of eye contact, head nodding, rapid eye blinking, hand tapping, jaw jerk, and tongue thrust might occur along with the primary behaviors (Ward, 2008).

To summarize, adults have longer, tense blocks with tremors of lips, jaw, or tongue. They might have repetitions and prolongations too. Through extensive avoidance behavior, stuttering might be suppressed in some individuals. Complex escape and avoidance behaviors may be very rapid and well established that the person with stuttering him/herself is unaware. Emotions related to shame, fear and embarrassment might be very strong. Self-concept may be pervasive and negative feelings might be too strong (Guitar, 2014).

2.4. Quality of life

Stuttering has a significant effect on a person's participation in daily activities (Yaruss & Quesal, 2006). There are many everyday experiences of social anxiety in persons who stutter. Quality of life has been studied using questionnaires, rating scales, etc. It was found that the majority of the adults who stutter perceived their stuttering to be a handicap concerning employment opportunities and job

performances (Klein & Hood, 2004). Persons with stuttering have high risks of experiencing fatigue, a subjective state associated with feelings of distress, and poor mood, as opposed to more physical aspects of tiredness. Adults with stuttering might have low social functioning, impacting their social interaction capacity. Also, they might be having emotional instability and poor mental health status. The research shows that there are heightened risks of anxiety in adults with stuttering (Craig et al., 2006).

Characteristics of the individual and environment, symptom status, and functional status are the factors that have an impact on the quality of life. By applying numerous strategies as per the convenience of a person, quality of life could be maximized.

To develop rational and effective treatments, it is essential to understand the factors contributing to the quality of life. Therapeutic goals must target the inadequate and improper coping strategies of a person to help deal with stressors that give rise to stuttering, more effectively. Thus, a decrease in the ramifications on the quality of life can be noticed.

Poor mental and emotional health, fatigue, and social anxiety are essential to be addressed while treating adults with stuttering. Treatments that increase feelings of self-esteem, self-efficacy, and strengthen the support from the family will enhance the quality of life of people who stutter (Boyle, 2015).

2.5. Assessment of stuttering in adults

Assessment plays a significant role in diagnosing, treatment planning, and evaluating the effects of treatment. In adults, the assessment does not target just the speech aspects, but way beyond that. It is important to have a comprehensive case

history and extract information regarding various aspects, including the cause (developmental/acquired), the course, fluency count, attitudes, thoughts and beliefs, quality of life, etc (Ward, 2008).

Assessment of stuttering is a broad topic that can be divided into several different targets, such as frequency, type, duration, and severity of dysfluencies. It is also important to assess speech naturalness and rate, type of secondary behaviors, attitudes and feelings, and quality of life in adults. The severity of stuttering is usually based on the percentage of syllables stuttered. Stuttering severity varies from very mild to very severe. Higher the percent of dysfluency more is the severity of stuttering.

$$\frac{\text{No. of syllables stuttered}}{\text{No. of syllables spoken}} * 100 = \% \text{ syllables stuttered}$$

Speech profiling is crucial and requires multiple samples in various speaking situations. In the same person, the severity and types of stuttering events might vary in different situations and at different times. Craig (2004) suggests ideally two to three different speech samples for a reliable and valid evaluation. Spontaneous speech samples, including reading, monologue, conversation, and any other relevant context, are important in assessing stuttering in adults (Yairi & Seery, 2015). It is essential to consider the other speaking issues, including phonology, syntax, semantics, pragmatics, cognition, motor skills, suprasegmentals, hearing abilities, etc. that may influence the person's speech, language and communication skills.

Different authors recommend different sample sizes for obtaining valid and reliable data for analysis of stuttering. No significant difference was observed in the number of dysfluencies between samples of sizes ranging from 300 to 1800 syllables

(Roberts et al., 2009). Shapiro (1999) recommended 300 to 400 words, while Roberts et al. (2009) and Ward (2008) suggested a speaking time of 3 or 5 minutes. Yairi and Ambrose (2005) argued that a larger sample size of at least 600 syllables helps extract specific types of dysfluencies that occur at lower frequencies.

2.5.1. Assessment tools

The Stuttering Severity Instrument (SSI-4; Riley, 2009) and the Iowa Scale of Severity of Stuttering (Sherman, 1952) are widely used for quantifying the severity of stuttering. Both scales measure the frequency of dysfluencies, their duration, and the magnitude of concomitant characteristics. In SSI-4, independent ratings are obtained for each of the sections mentioned above and combined to derive an overall score. Spontaneous speech and oral reading tasks are considered to obtain speech samples. Samples beyond the clinic setting are also encouraged. These samples are subjected to analysis to measure the percentage of syllables stuttered, the average duration of the three longest stuttering moments, and the intensity of distraction perceived by concomitant behaviors. The severity of stuttering is classified as very mild, mild, moderate, severe, and very severe based on the overall score. Speech naturalness rating (Martin et al., 1984) and self-reported rating scales are also included in SSI-4. It is a reliable and valid norm-referenced stuttering assessment tool.

Several formal instruments have been published to assess attitudes related to stuttering. These include the Overall Assessment of the Speaker's Experience of Stuttering (OASES; Yaruss & Quesal, 2006), the Communication Attitude Test (Brutten & Dunham, 1989) and the Modified Erickson Scale (Andrews & Cutler, 1974). Attitude assessment and situation ratings are included in the OASES. It can be administered on adults aged 18 and above, to assess the global impact of

stuttering on their lives. Clients respond to 100 items in 4 sections using a 5-point rating scale that differs in meaning across sections.

- General information: involves gathering details about the client's perceptions of speaking ability, knowledge regarding stuttering disorder, and beliefs about stuttering and speaking.
- Reaction to Stuttering: address experiences, emotions, and attitudes related to stuttering.
- Communication in Daily situations: a hierarchy of speaking situations are charted based on the level of difficulty.
- Quality of Life: address the negative impact or interference of stuttering with the client's life, personally, socially, and vocationally.

Each section's scores are converted to Impact Ratings interpreted on a 5 level scale, ranging from mild to severe.

Assessment tools for anxiety in persons who stutter are also widely used while dealing with those having social anxiety related to their fluency disorder. The Unhelpful Thoughts and Beliefs About Stuttering (UTBAS; Clare et al., 2008) is a self-rating scale that offers an extensive measure of the unhelpful cognitions associated with social anxiety in stuttering. It consists of 66 items that assess various unhelpful thoughts and beliefs. The person has to rate the items between 1 (never) and 5 (always), as to how much he/she believes thoughts such as, "People will doubt my ability because I stutter," "It's impossible to be really successful in life if you stutter," "I won't be able to keep a job if I stutter."

2.6. Management of stuttering in adults

Treatment of stuttering in adults must focus on various aspects other than just the speech-related. The treatment goals must be to reduce the abnormality of stuttering (stuttering modification), the frequency of stuttering (fluency shaping), negative feelings, beliefs, thoughts and attitudes about stuttering and speaking (cognitive behavioral therapy), and avoidance; increase overall communication skills, and create a fluency facilitating environment. To increase the communication abilities, specific skills like maintaining eye contact, speaking intelligibly, taking turns effectively, maintaining a topic, making relevant contributions to the conversation, clarifying and repairing the speech, and developing communication willingness (Smith, McCauley, & Guitar, 2000).

Stuttering modification procedures are appropriate for persons who have developed struggle, tension, escape, and avoidance behaviors. Reward and mild punishment strategies are used accompanied by a systematic program for reducing negative emotions, to change long, tense stutters into increasingly briefer and more relaxed ones, and to diminish escape and avoidance behaviors. Van Riper's approach (1975b) includes identification, desensitization, variation, cancellation, pullout, stabilization, etc. The therapist trains the person to correct his/her stuttering after a stutter, during a stutter, then before the stutter occurs.

Fluency shaping procedures involve using reinforcement for fluency and mild punishment for stuttering. AWS learn to modify their speech by speaking slowly to produce instant fluency, then proceeding with a normal-sounding speech in difficult hierarchical situations. Prolongation technique is one of the most used fluency shaping techniques.

Guitar (2014) suggested a combination of stuttering modification and fluency shaping techniques referred to as the "integrated approach."

Some well-known techniques include a comprehensive stuttering program (Boberg & Kully, 1985), stuttering modification approach (Van Riper, 1973), approach-avoidance conflict therapy (Sheehan, 1975), the Camperdown program (O'Brian et al., 2001) based on prolonged speech technique, and many more. Few alternative methods are widely followed, including altered feedback, choral and shadowed speech, masked auditory feedback, delayed auditory feedback, frequency altered auditory feedback, drug therapy, etc.

Prolonged speech. While using prolonged speech, the person speaks slowly without excess tension, resulting in stutter-free speech. Gentle onsets are one of the important features combined with the slow rate of speech. The slow and unnatural speech is hierarchically shaped into a more natural-sounding speech.

Onslow et al. in 1996, assessed speech of 12 clients prior to treatment and multiple times during and post-treatment. It was found that all the clients who received a two to three years program achieved minimal or no stuttering. Regression in the percentage of syllables stuttered or speech naturalness during the post-treatment period was not observed in most clients. Also, unusual slow and unnatural patterned speech was absent.

Andrews et al. in 1980 conducted a meta-analysis of the effect of stuttering treatment and concluded that prolonged speech and gentle onsets are superior to other techniques. Regression is slower in these techniques, even for chronic conditions.

In a study by O'Brian et al. in 2003, 16 participants availed the Camperdown Program, which was based on the Prolonged Speech technique, and speech samples were collected 12 months post-treatment. Zero to near-zero stuttering with normal speech rates in everyday situations was observed for up to 12 months after the maintenance phase.

A study by Georgieva (2018) included measuring outcomes like percentage of syllables stuttered, speech naturalness, and self-report inventory, before, immediately, and after 18 months of treatment. Intensive treatment using the prolonged speech technique was provided. Results showed that all the AWS responded equally well, and positive measures were observed in all the outcomes.

Metronome. It is a rhythmic sound generating device using which a person's rate of speech is controlled. It provides beats of sound at a particular rate, which can be changed as per the person's convenience. The person utters syllables/words at the rate of the beats. Usually, persons who stutter have a fast rate of speech due to various primary and secondary stuttering behaviors. Using a metronome, a person learns to speak slow and clear. Hierarchically, his/her speech rate is changed from slow to normal adult rate, as and when he/she learns to speak fluently in those rates. A practical range of rates is from 30 to 150 beats per minute. However, persons with severe stuttering usually are treated with a very slow rate of about 40 beats per minute (Brady, 1971).

Metronome tends to be more effective than self-pacing, as the former provides an externally generated stimulus (Barber, 1940). Clients slowly learn to experience fluent speech in the presence of the metronome's beats. These beats serve as the conditioned stimuli to elicit a relaxed state and fluent speech when used for a

long time. Significant better fluency in the speech was observed when the metronome was set at 93 beats per min than 184 (Barber, 1940). Brady (1969) proved that the effect of the metronome in auditory, visual, and tactile modalities was equivalent in pacing speech and improving fluency.

Passive airflow. Schwartz (1976) developed the passive airflow technique, based on a principle that stuttering occurs due to laryngospasms. Lee (1976) provided intensive (Phase I) part of the treatment for 31 AWS and found that 90% of the participants were stutter-free in various situations. However, only 46% of the participants were reported to be stutter-free in all everyday situations at the end of Phase II.

In another study by Andrews and Tanner (1982), six clients were given group therapy for over five days. A significant treatment effect was reported after four days, but relapse was at 30 days, and by the end of the year, all the participants experienced a relapse in speech fluency. They recommended 30 clinical hours per client for effective treatment outcomes.

Cognitive behavioral therapy. In a study by Gupta (2016), cognitive behavior therapy (CBT) was used to examine the efficacy of reducing anxiety, avoidance behavior, frequency of stuttering, and increasing the social interaction, self-esteem, positive thoughts and attitudes about verbal communication. Pre- and post-management assessments were done using Rosenberg Self-Esteem Scale (RSES), Perceptions of Stuttering Inventory (PSI), Modified Erickson Scale of Communication Attitudes (MESCA), Stuttering Severity Instrument (SSI), and Beck Anxiety Inventory (BAI). The CBT program consisted of 25 sessions, and each

session lasted for 45–50 min duration. A significant improvement was observed on both pre- and post-management scores. The severity level came down significantly after implementing structured and need-based 25 sessions of CBT program and was maintained at a one-year follow-up. The author concluded the effectiveness of CBT in anxiety reduction, positive attitude development, self-esteem, problem-solving, and communication competence in AWS.

CBT had reduced stuttering, lowered anxiety, and negative attitudes about speaking in person who stutters (Moleski & Tosi, 1976). CBT did not affect the number of syllables stuttered, but it reduced the anxiety in the persons who stutter, and they could speak more freely without aversive thoughts (Menzies et al., 2008). CBT was found to bring positive alterations in stuttering related attitudes and thoughts consistently, but not in the frequency of dysfluencies (McDonald, 2012). Also, many studies support CBT but lack control or comparison groups and follow-up data (Menzies et al., 2009).

2.7. Telehealth and telepractice

"Telehealth or telemedicine is the use of information technology and telecommunications to support or deliver health services (Project for Rural Health Communications and Information Technology, 1996)." It has a high potential to provide treatment services overcoming the access barriers existing in many countries (Wilson et al., 2002). It has been a feasible alternative to the in-person service delivery models in medical and allied health services (Craig et al., 1999; Elford et al., 2000; Krumm et al., 2004; Schopp et al., 2000; Wootton et al., 2000).

Telepractice (ASHA, 2014) is designed to use telecommunications technology to link "clinician to client/patient or clinician to clinician for assessment,

intervention, and/or consultation." It has been experimented and accepted by professionals with free software applications and high-speed internet connectivity.

Telepractice has been used to deliver services to persons with various communication disorders, such as neurogenic communication disorders (Armfield et al., 2012; Georgeadis et al., 2004; Theodoros et al., 2008); voice disorders (Halpern et al., 2012; Howell et al., 2009); childhood speech-language disorders (Grogan-Johnson et al., 2009); and stuttering disorders (Carey et al., 2012; Lewis et al., 2008; Irani & Gabel, 2011; O'Brian et al., 2008; Sicotte et al., 2003; Wilson et al., 2004).

This alternative service delivery model has various advantages with respect to planning, scheduling, delivering, and accessing treatment (Blaisier et al., 2013). Current barriers to telepractice include issues related to internet connectivity, confidentiality, professional licenses, and lack of payment for services (Cohn, 2012; Cohn et al., 2011).

2.7.1. Telepractice in Stuttering

Researchers have been exploring the various aspects of telepractice, its advantages and disadvantages as well.

Inexpensive and useful computer software, Speech Fluency Treatment, was studied by Awad in 1997. It worked by illustrating the client's speech irregularities by generating audio and visual cues. The real-time display of the client's speech served as feedback and provided a platform to compare with the reference speech profiles. Using this, the clients could alter their speech to improve fluency.

Kully (2000) used video conferencing for post-treatment consultation after two months with a client who completed an intensive Comprehensive Stuttering

Program. The clinician and the client reported satisfaction with the session's structure and the effectiveness of the feedback.

Ai and Yunus (2007) presented a paper on a computer-based system tool to assess the efficacy of stuttering therapy techniques. Digital Signal Processing was used to analyze speech signals and incorporate recognized fluency shaping techniques like shadowing, using a metronome, and delayed auditory feedback into the software, post discussion with SLP. It provided real-time visual and audio feedback of the client's speech patterns and self-training assistance. The result of this study revealed that the software assisted SLPs in determining suitable techniques for each client.

In another case study by Irani and Gabel (2011), an AWS was assigned an intensive three-week in-person therapy program. Then, the client was enrolled for treatment via telepractice, twice a week for six months, weekly once for another six months. A decline was observed in the frequency of syllables stuttered. Further, the participant reported a positive change in his attitudes and self-image. Thus, hybrid treatment programs could help deal with the core behaviors, attitudes, and emotions concerned with stuttering.

Like the clinic-based services, telepratice also delivers services via videoconferencing, phone calls, and Internet software. Further, the telepractice targets to teach and practice the techniques, practice natural-sounding speech, learn to self-evaluate, generalize, and maintain fluent speech in various contexts.

McGill et al. (2019) reviewed seven studies, one of them on an adult, on telepractice for stuttering treatment. It was reported that the telepratice delivered almost similar levels of success as the traditional face-to-face therapy, valid with

various programs like the Lidcombe program, Camperdown program, integrated approach. Moderate to high satisfaction was rated by the clinicians who participated in these studies. Further research is required for validating, correcting the glitches, and improving the features of the telepractice. (McGill et al., 2019).

The literature in the field of stuttering provides opposite outcomes regarding the effectiveness of computer-based software. It is the client's right to be informed of the various stuttering management approaches and select appropriate treatments to meet his/her needs. Moreover, the whole management program is a decision taken in unison by the therapist and the client. The inclusion of a computer-based device into the management plan becomes an individual choice determined by each client's values and treatment objectives.

As there are variations in the disorder of stuttering concerning various aspects of every individual, a therapist needs more time to choose a preferable technique for each client. The module can assist therapists with trial and error methods to implement various combinations of techniques and decide regarding the best suitable technique.

Chapter 3

Method

The objectives of the present study were, to develop a computer-based module that would aid in intervention of AWS and to orient clinical practitioners of Speech-Language Pathology regarding the use of telepractice in rehabilitation.

This module is designed to further assist the young clinicians to better understand the normal speech production physiology, dysfluencies, secondary behaviors, etc in AWS and the various therapy techniques used to treat them.

The study was carried out in three phases:

Phase I: Pilot study to determine the need of a computer-based module for rehabilitation of AWS.

Phase II: To develop the contents for the module and validation of the same by SLPs.

Phase III: To incorporate the validated content into a computer-based module and validation of the same by SLPs.

3.1. Phase I- Pilot study

3.1.1. Objective

As a part of this, a pilot study was conducted to evaluate various factors related to providing effective therapy for AWS. A questionnaire was developed as per the objectives of the study, to find out the need and importance of a computer-based module for rehabilitation of AWS. It also targeted the knowledge, experience, and confidence of SLPs while managing AWS in clinical practice.

3.1.2. Method

A questionnaire was developed containing 16 items (including 5 subjective and 11 objective types) and was administered on randomly selected 12 SLPs with an experience of providing therapy to AWS for <1 year, 1-2 years and >2 years (4 SLPs under each group). A general feedback was collected regarding use of therapeutic aids and materials, and clinical utility of the same while providing therapy for AWS. The items in the questionnaire targeted the following aspects:

i. Confidence of clinician while providing therapy
ii. Experience in terms of number of adult clients they have handled
iii. Ability to demonstrate techniques appropriately
iv. Comprehensibility of the techniques by the clients
v. Use of any aids for the demonstration of techniques
vi. Ability to prepare appropriate lesson plans by the SLPs
vii. Ease of access of therapeutic aids/materials for providing therapy
viii. Maintenance of progress record on day to day basis
ix. Confidence in counseling
x. Ability to determine the prognosis
xi. View about a computer-based therapeutic module- whether it would help overcome the problems faced in the above mentioned items

Also, certain subjective questions were asked regarding the various facilities that a computer-based module should be offering for the management of AWS.

3.2. Phase II- Module Development

3.2.1. Content preparation

Stuttering is a heterogeneous disorder. There are numerous techniques suggested by various authors for the management of AWS. The content for module was prepared by compiling information from various evidence based practices used in stuttering management. The content includes the following:

a. Overview to the module

b. Overview of the stuttering disorders in adults

- Brief information using audio-video and animated materials about stuttering including signs, causes, severity, course, quality of life, assessment, treatment, and myths and facts

c. Animated demonstration of the mechanism of speech production

- Role of various subsystems involved in the mechanism of speech production

d. Awareness regarding the types of dysfluencies

- Brief information and demonstration through audio-video samples

e. Awareness regarding the various types of secondary behaviors

- Brief information and demonstration through audio-video samples

f. Pre-therapy base-rating

- Recording sheet for storing details

g. Description and animated demonstration of evidence based therapy techniques

h. Activities to improve the communication skills

i. General tips for others while communicating with AWS

j. Documentation of the progress in the clients' fluency using the recording sheet

The content and videos were prepared by the author and the guide after referring to various resources on stuttering management.

3.2.2. Development of animation and videos

Animations were developed by a team of three members pursuing bachelors in design from IIT Mumbai, the author and the guide. Description of each animation is as follows:

i. Animation for Light contacts: It is illustrated and animated using Procreate software.

ii. Animation for Prolongation technique: It is illustrated using Adobe Illustrator software, animated using Adobe After Effects application, edited video using Adobe Premiere Pro app and coded using Adobe Animate CC program.

iii. Animation for Metronome: It is illustrated using Adobe Illustrator software, animated using Adobe After Effects application, edited video using Adobe Premiere Pro app and coded using Adobe Animate CC program.

iv. Animation for Reinforcement: It is illustrated using Adobe Illustrator software, animated using Adobe After Effects application, edited video using Adobe Premiere Pro app and coded using Adobe Animate CC program.

Videos demonstrating various types of dysfluencies and secondary behaviors were recorded using a digital single lens reflex camera, Canon EOS 80D.

Further, the design, color, animations, transitions, overall features were finalized by the team consisting of the author, guide, speech technologist and the animation designers

3.2.3. Validation of the content

A questionnaire was developed which contained 10 items (yes/no questions) and was given to 10 SLPs with an experience of 2 years of providing therapy to AWS. A general feedback was collected regarding the content, videos and animations developed for the computer-based module. The items in the questionnaire targeted the following aspects:

a. Applicability/utility of the techniques chosen to the clinical setting

b. Length of the module

c. Appropriateness of the animations and videos for each of the techniques, types of dysfluencies & secondary behaviors

d. Usage of animations with respect to their controls and if they are interesting for AWS during therapy

e. Usefulness of the module to complement and supplement the knowledge of SLPs and other team members (client/ caregivers) with respect to stuttering management.

Also, the SLPs were asked to provide suggestions to improve the contents of the module including the written content, animations and videos.

3.3. Phase III- Computerized version of the module

The Computer-based Module was named as the Assistive Stuttering Interface- Adults (ASI-A). It was designed by a speech technologist using HTML, CSS, and JavaScript.

3.3.1. Validation of the module

A questionnaire was developed which contained 12 items (yes/no questions) and was given to the 10 SLPs who participated in Phase II of the study. A general feedback was collected regarding the computer-based module. The items in the questionnaire targeted the following aspects:

a. Framework of the contents of the module
b. Ease of use & accessibility
c. Visual display of the module
d. Technical issues
e. Utility in teletherapy

Chapter 4

Results and Discussion

This study's primary objectives were to develop a computer-based module that would aid in the intervention of AWS and orient clinical practitioners of Speech-Language Pathology regarding the use of telepractice in rehabilitation.

4.1. Phase I- Pilot study

The pilot study was conducted to evaluate various factors related to providing effective therapy for AWS. The questionnaire developed and administered on randomly selected 12 SLPs, had 15 items (including five subjective and 10 objective types). It was administered to find out the need and importance of a computer-based module for AWS therapy. Table 1 depicts the responses.

Table 1

Pilot study

PARAMETERS	**EXPERIENCE**					
	< 1 YEAR		1-2 YEARS		>2 YEARS	
	YES	NO	YES	NO	YES	NO
1. Are you confident to provide therapy for adults with stuttering?	4	-	4	-	4	-
2. Can you demonstrate the techniques to your clients appropriately?	4	-	4	-	4	-
3. Can your clients understand the techniques that you have demonstrated?	4	-	4	-	4	-

4. Do you use any aids to demonstrate the techniques?	-	4	2	2	3	1
5. Can you prepare a structured therapy plan for various techniques?	4	-	4	-	4	-
6. Can you access the therapeutic materials for stuttering easily?	2	2	2	2	3	1
7. Do you maintain a proper record of the progress of your client on day to day basis?	2	2	3	1	3	1
8. Are you confident in counseling your clients about effective home training?	4	-	4	-	3	1
9. Is it easy to determine the prognosis for your clients?	3	1	3	1	3	1
10. Do you think a module for stuttering would help with techniques, tasks and progress report making?	4	-	4	-	4	-

All the 12 SLPs reported that they were confident in providing therapy to AWS, demonstrating techniques, preparing appropriate therapy plans, and positively recommended the development and need of a computer-based module.

Five out of twelve SLPs reported using of aids to demonstrate techniques. Seven of the SLPs could access the therapeutic materials for stuttering easily. Eight SLPs maintained a proper record of the progress of clients daily. It was observed that SLPs with less experience did not use any aid to demonstrate the techniques, faced difficulty accessing the therapeutic materials, and did not maintain a proper record of

the progress when compared to the SLPs with greater experience in stuttering therapy.

A list of features and support expected from the module was gathered from the participants. The recommendations made were:

1. Project the frequency of errors.
2. Provision for explaining the mechanism of speech production and occurrences of dysfluencies.
3. Demonstration videos of various techniques.
4. Inclusion of activities during each phase.
5. Focus on improving the secondary behaviors, including the psychological aspects of stuttering.
6. Must provide feedback, mainly to track if the techniques are being followed or not.
7. Documentation of progress based on the stages or phases; session report at the end of the session- using various quantitative and qualitative methods.

The study revealed that the clinicians did face some issues concerning therapy while dealing with AWS. All 12 clinicians recommended a computer-based module and justified that it would support and guide them throughout the therapy programs. They also reported that it would help young clinicians learn the techniques and demonstrate them appropriately and confidently. Thus, the present study supports the earlier reports on telepractice in stuttering therapy. A case study conducted by Kully in 2000, enrolled an adult with stuttering in telepractice treatment, post 3-week intensive in-person treatment. The telepractice targeted

practicing fluency techniques and solving other real-life problems. Overall satisfaction was reported by the client.

McGill et al. (2018) reviewed seven studies, one of them on an adult, on telepractice for stuttering treatment. It was reported that the telepratice delivered almost similar levels of success as the traditional face-to-face therapy, valid with various programs like the Lidcombe program, Camperdown program, and integrated approach. Moderate to high satisfaction was rated by the clinicians who participated in these studies.

Since all the twelve SLPs recommended the clinical utility of computer-based module for rehabilitation, the need for the current study was met.

4.2. Phase II- Module development

The module's content and videos were prepared by compiling information from various evidence-based practices used in stuttering management. Animations were developed by a team of three members, pursuing bachelor in design from IIT Mumbai, the author, and the guide.

A questionnaire was developed and administered on 10 qualified SLPs, which contained 10 items (yes/no questions). The general feedback was collected regarding the content, videos, and animations developed for the computer-based module. Table 2 depicts the responses.

Table 2

Content Validity

QUESTIONS	YES	NO

1. Are the techniques chosen, relevant to our clinical set-up?	10	-
2. Do you feel the module is lengthier, considering the contents?	-	10
3. Are the animations in accordance with techniques mentioned?	10	-
4. Do you think the animations made are interesting for the client?	10	-
5. Are the animations easy to use in terms of using the controls?	10	-
6. Does the module complement your theoretical knowledge?	10	-
7. This module was prepared with the intention to provide relevant information about stuttering for clinicians, clients, parents, and caregivers. Do you think the same objective is met?	10	-
8. Are the videos demonstrating the contents (signs of stuttering, types of dysfluencies, etc) of the module comprehensive/appropriate?	10	-
9. Do you think that this module can be used to treat stuttering of various severities?	10	-
10. Do you think the content of the module is comprehensive to clinicians with varying experiences in stuttering	10	-

rehabilitation (Undergraduate/ Postgraduate)?

All the 10 SLPs validated the content and mentioned that the module would provide relevant information about stuttering to the clients and caregivers. Further, the suggested modifications were incorporated while making the final content of the module. The suggestions included improving the audio quality of the videos demonstrating the techniques and including the instructions for using the animations in the module.

4.3. Phase III- Computerized version of the module

The computerized version of the module was developed using HTML, CSS, and JavaScript. A questionnaire containing 12 items (yes/no questions) was developed and administered for validating the computerized version of the module on the same participants of Phase II of the study to obtain a consensus regarding the same. The general feedback was collected regarding the computer-based module. Table 3 depicts the responses.

Table 3

Feedback regarding the computerized version

QUESTIONS	YES	NO
1. Are the contents of the computer-based module well-organized and easily accessible?	10	-
2. Do you feel the computer-based module would help in providing therapy?	10	-

3. Is the computer-based module user-friendly in the clinical set-up?	10	-
4. Are the instructions mentioned in the module for the techniques, simple and easy to follow?	10	-
5. Is the module visually appealing? (For ex: font, color, background etc)	10	-
6. Do you think that the animations are in accordance with the technique mentioned?	10	-
7. Are the animations easy to use in terms of using the controls?	10	-
8. Did you face any technical issue while using the module?	10	-
9. Do you think there will be a better clinical utility of the module if made into a mobile phone application?	8	2
10. Do you think this module can be used in teletherapy?	10	-
11. Do you think hybrid mode of intervention (in-person service delivery + teletherapy) is more beneficial than each of them when used alone?	10	-
12. Do you think this module will be more useful for children or adults or both?	Both (10)	-

All the SLPs gave positive feedback regarding the computerized version of the module. Various aspects of the module were evaluated using the questionnaire, and all the participants reported that the framework of the contents in the module was well organized. All the SLPs agreed on the ease of use of the videos, animations, their controls, and accessibility of the contents. The module was reported to be visually appealing by all the SLPs in terms of the layout, background, font, and color. No major technical issues were reported. However, clinicians had concerns with respect to the utility of the computer-based module in the clinical setup. One of the participants highlighted that the module might not be used all times, especially when there are internet connectivity issues. There were comments on enhancing the visual appeal of the module in terms of highlighting the important points. Some clinicians faced issues with the speed of animations, audibility of the videos, which were addressed in the final revision of the module.

However, all the participants agreed that the computer-based module could be beneficial in providing therapy via both in-person and distance mode. This supports a previous study by Awad (1997), who presented a paper on computer software, Speech Fluency Treatment, for illustrating the client's speech irregularities using audio and visual cues. This served as feedback to the client and helped alter various aspects of speech fluency.

Ai and Yunus (2007) presented a paper on a computer-based system tool to assess the efficacy of stuttering therapy techniques. It incorporated techniques like shadowing, using a metronome, and Delayed Auditory Feedback (DAF). The software provided real-time visual and audio feedback. The result of this study revealed that the software assisted SLPs in determining suitable techniques for each client.

The clinicians also agreed on the usefulness of the computer-based module while providing therapy using the hybrid mode that combines in-person service delivery and telerehabilitation. This supports a case study by Irani and Gabel (2011), who with hybrid mode of service delivery, reported a decline in the percentage of syllables stuttered, positive change in attitudes and self-image. Thus, hybrid treatment programs can help deal with the primary stuttering behaviors and the attitudes and emotions about stuttering.

Chapter 5

Summary and Conclusion

This study's main objectives were to develop a computer-based module that would aid in the intervention of AWS and orient clinical practitioners of Speech-Language Pathology regarding the use of telepractice in rehabilitation.

The study was carried out in three phases. In Phase I, a pilot study was conducted to determine the need for a computer-based module for the rehabilitation of AWS. Phase II comprised of the development of the contents for the module and validation of the same by SLPs. Phase III was accomplished by incorporating the validated content into a computerized version which was further subjected to feedback by SLPs.

A computer-based module was developed with the aim of providing a comprehensive platform for the clinicians to gather better understanding of the different treatment techniques. This module was created to supplement their clinical knowledge to improve service delivery in stuttering rehabilitation. The study was first carried out from the pilot, where the information was sought regarding the computer-based module and its efficacy. Then, the contents of the module were prepared and subjected to content validity. Modifications were made and incorporated into the computer-based module, depending upon the suggestions obtained. The computer-based module was developed using HTML, CSS, and JavaScript. The module comprised of

- Overview to the module,

- Overview of stuttering including the causes, signs, severity, course, quality of life, assessment, treatment, and myths and facts,
- Speech production mechanism,
- Types of dysfluencies,
- Secondary behaviors,
- Pre-therapy base rating and recording sheet,
- Therapy techniques,
- Activities to improve communication skills, and
- General tips to be followed.

The recording sheet is designed to document the demographic details of clients and quantify the severity of stuttering. It can also be used to document and track the progress at regular intervals. The types of dysfluencies and therapy techniques were demonstrated using videos. Also, automatic and manual animations were included for the learning of the techniques. These animations can also be used during generalization, self-monitoring, and maintenance phases of therapy.

There are multiple advantages to this module.

The benefit to the clinicians:

- It is one of the first modules to be developed at AIISH for stuttering management.
- Brief concepts regarding stuttering are given, including the signs, causes, severity, course, quality of life, types of dysfluencies, secondary behaviors, assessment, and management.

- It includes a visual representation of normal speech production mechanism, types of dysfluencies, and therapy techniques, which will help the clinicians explain better to the clients/caregivers about stuttering.
- It will aid in delivering better therapeutic services in stuttering management.
- It will be useful for clinician training.

The benefit to the clients:

- Visual representations of various aspects, including speech production mechanism, types of dysfluencies, and therapy techniques, are provided for a better understanding of stuttering.
- The therapeutic techniques are explained in detail, which will help clients to follow every step with ease.
- Animations and videos are provided for various techniques, which will assist in better learning, understanding, and practice in every speaking task.
- Clinician controlled visual feedback is provided, which will further help in learning and practicing the techniques.
- It can be used to provide teletherapy with remote desktop access tools (TeamViewer/AnyDesk) installed in the client's and clinician's computers.
- It is cost-effective and time-effective, as people do not have to travel to avail services.

Limitations and future directions:

- Internet connectivity is required in order to access the computer-based module. Hence, this can be upgraded into an internet-free version.

- There may be constraints to the module's usage as it has been developed in English language. The module could be translated into various languages to benefit more individuals with stuttering.
- The manually controlled animations have an average speed of response. They can be modified and upgraded using sophisticated tools in future.
- The module comprises of only four evidence-based techniques. Thus, more evidence-based techniques can be incorporated for clinician training and clinical utility.
- The provision for the audio-video recording of the speech sample would be beneficial for the clinicians in the clinical setup.
- Various activities can be provided in the module for each phase to make the learning of the techniques more interesting.
- Field testing of the module can be taken up to check for efficacy.

To conclude, this module has been developed as a training supplement and as a rehabilitation aid. We hope that this computer-based module is used extensively by the clinicians in stuttering rehabilitation, and paves a new path in telerehabilitation for stuttering.

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Appendix

QUESTIONNAIRE 1- Pilot study

1) Are you confident to provide therapy for

   i. Adults with stuttering?

      a) Yes b) No

   ii. Children with stuttering?

      a) Yes b) No

2) Can you demonstrate the techniques to your clients appropriately?

   a) Yes b) No

3) How many techniques do you have a sound knowledge of?

   i. Prolonged Speech

      a) 0-25% b) 26-50% c) 51-75% d) 76-100%

   ii. Modified Airflow

      a) 0-25% b) 26-50% c) 51-75% d) 76-100%

   iii. Relaxation

      a) 0-25% b) 26-50% c) 51-75% d) 76-100%

   iv. Slow rate of speech

      a) 0-25% b) 26-50% c) 51-75% d) 76-100%

   v. Soft articulatory contacts

      a) 0-25% b) 26-50% c) 51-75% d) 76-100%

   vi. Pause and talk

      a) 0-25% b) 26-50% c) 51-75% d) 76-100%

   vii. Metronome

a) 0-25% b) 26-50% c) 51-75% d) 76-100%

viii. Altered auditory feedback- DAF/FAF/MAF

a) 0-25% b) 26-50% c) 51-75% d) 76-100%

ix. Finger thumb

a) 0-25% b) 26-50% c) 51-75% d) 76-100%

x. Lily Pad

a) 0-25% b) 26-50% c) 51-75% d) 76-100%

xi. Response cost

a) 0-25% b) 26-50% c) 51-75% d) 76-100%

xii. Van Riper's traditional approach

a) 0-25% b) 26-50% c) 51-75% d) 76-100%

xiii. GILCU (Gradual increase in length and complexity of utterance)

a) 0-25% b) 26-50% c) 51-75% d) 76-100%

xiv. Time out

a) 0-25% b) 26-50% c) 51-75% d) 76-100%

xv. Cognitive Behavioral Therapy

a) 0-25% b) 26-50% c) 51-75% d) 76-100%

4) How did you learn these techniques?

a) Supervisors b) Internet c) Existing videos in the unit d) Seniors

5) Mention the techniques that you would often use during therapy. Specify for adults and children separately.

_____

_____

6) Can your clients understand the techniques that you have demonstrated?

i. Adult

a) Yes b) No

ii. Children

a) Yes b) No

7) Do you use any aids to demonstrate the techniques?

i. Adult

a) Yes b) No

If yes, mention.

_____

ii. Children

a) Yes b) No

If yes, mention.

_____

8) Can you prepare a structured therapy plan for various techniques?

i. Adult

a) Yes b) No

ii. Children

a) Yes b) No

9) Can you access the therapeutic materials for stuttering easily?

i. Adult

a) Yes b) No

ii. Children

a) Yes b) No

10) Do you maintain a proper record of the progress of your client on day to day basis?

a) Yes b) No

11) Are you confident in counselling your clients/ parents about effective home training?

a) Yes b) No

12) Is it easy to determine prognosis for your clients?

a) Yes b) No

i. How do you rate your success in providing therapy for stuttering?

a) 25% b) 50% c) 75% d) 100%

13) Mention how you will quantify the progress.

_____

_____

14) Do you think computer software program for stuttering would help with techniques, tasks and progress report making?

a) Yes b) No

15) What contents/features/components/support would you expect in a software for stuttering therapy? Mention separately for children and adults.

_____

_____

QUESTIONNAIRE 2- Content Validity

1. Are the techniques chosen, relevant to our clinical set-up?
2. Do you feel the module is lengthier, considering the contents?
3. Are the animations in accordance with techniques mentioned?
4. Do you think the animations made are interesting for the client?
5. Are the animations easy to use in terms of using the controls?
6. Does the module compliment your theoretical knowledge?
7. This module was prepared with the intention to provide relevant information about stuttering for clinicians, clients, parents, and caregivers. Do you think the same objective is met?
8. Are the videos demonstrating the contents (signs of stuttering, types of dysfluencies, etc) of the module comprehensive/appropriate?
9. Do you think that this module can be used to treat stuttering of various severities?
10. Do you think the content of the module is comprehensive to clinicians with varying experiences in stuttering rehabilitation (Undergraduate/ Postgraduate)?

QUESTIONNAIRE 3- Feedback regarding the computerized version

1. Are the contents of the computer-based module well-organized and easily accessible?
2. Do you feel the computer-based module would help in providing therapy?
3. Is the computer-based module user-friendly in the clinical set-up?
4. Are the instructions mentioned in the module for the techniques, simple and easy to follow?
5. Is the module visually appealing? (For ex: font, color, background etc)
6. Do you think that the animations are in accordance with the technique mentioned?
7. Are the animations easy to use in terms of using the controls?
8. Did you face any technical issue while using the module?
9. Do you think there will be a better clinical utility of the module if made into a mobile phone application?
10. Do you think this module can be used in tele-therapy?
11. Do you think hybrid mode of intervention (in-person service delivery + tele-therapy) is more beneficial than each of them when used alone?
12. Do you think this module will be more useful for children or adults or both?

Computerized version of the module: Assistive Stuttering Interface- Adults

The **Assistive Stuttering Interface- Adults**, a module for stuttering management, was developed by Ms. Archana U, under the guidance of Dr. Anjana B Ram, Assistant Professor in Speech Pathology, as a part of Master's Dissertation (2019-20) at AIISH, Mysuru. The computerized version of the module was developed by Mr. Karthik Venkat Sridaran, Speech Technologist, AIISH.

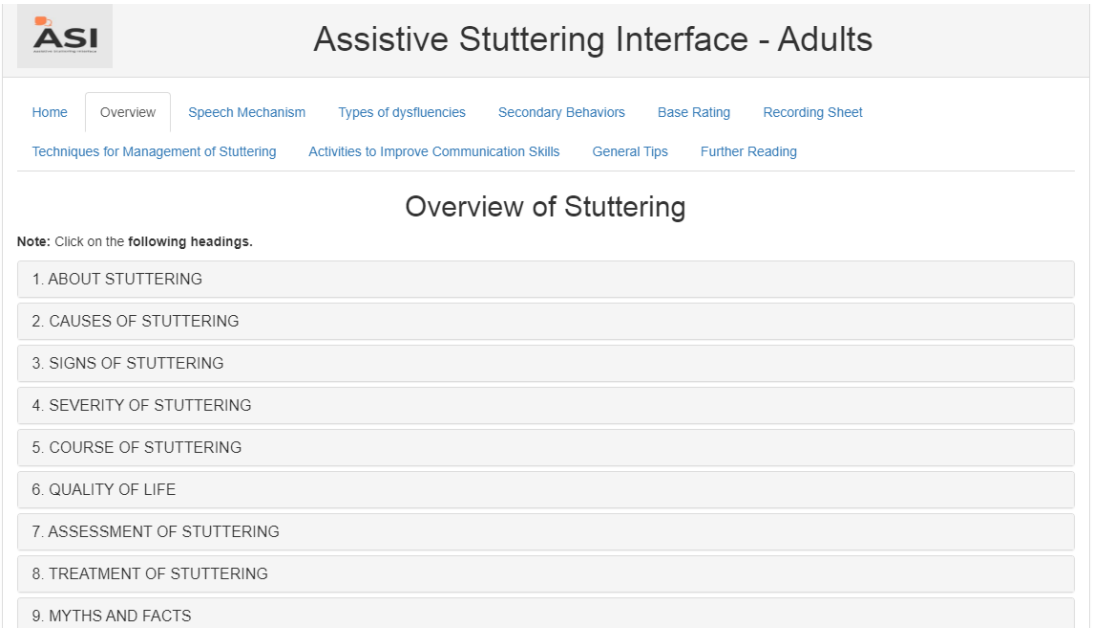
The major objectives include:

1. To develop computer-based module that will aid in intervention of adults with stuttering.

2. To orient clinical practitioners of Speech-Language Pathology regarding the use of telepractice in rehabilitation.

This module was developed assist the young clinicians to better understand the normal speech production physiology, dysfluencies in adults with stuttering, various secondary behaviors, and therapy techniques.

Here are few excerpts from the computerized version of the module



ASI

Assistive Stuttering Interface - Adults

Home | Overview | Speech Mechanism | Types of dysfluencies | Secondary Behaviors | Base Rating | Recording Sheet | Techniques for Management of Stuttering | Activities to Improve Communication Skills | General Tips | Further Reading

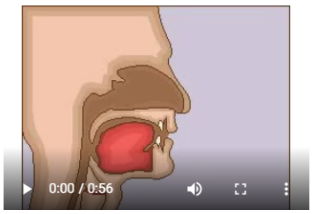
Speech Mechanism

Speech production is a complex process involving cognitive, neurological, and muscular processes. It is the process of generating speech, which is the final output of various sub-processes. These include thought formulation, selection, and arrangement of words according to the grammar, and finally, the pronunciation (articulation) of the planned and processed sequence of sound forms.

Speech is produced using the pulmonary air supplied by the lungs. The air is modified into puffs of sound through the larynx, by a process called phonation. These puffs are then modified in the vocal tract by the oral structures into sounds (vowels and consonants).

Lungs are the most important part of the speech system, as they provide the source for speech production. Pulmonary muscles expand and contract alternately for the inhalation and exhalation to take place alternatively. During exhalation, the air passes through the trachea, then the larynx.

The continuous airstream is modified into puffs of air by the vibration of the vocal folds. These puffs are further modified into different speech sounds by the various articulatory positions.



ASI

Assistive Stuttering Interface - Adults

Home | Overview | Speech Mechanism | Types of dysfluencies | Secondary Behaviors | Base Rating | Recording Sheet | Techniques for Management of Stuttering | Activities to Improve Communication Skills | General Tips | Further Reading

Types of Dysfluencies

Disruptions in the forward flow of speech may consist of:

- Repetitions: repeating of a syllable, sound, word, or phrase (e.g., "li-li-li-like this")

ASI

Assistive Stuttering Interface - Adults

Secondary Behaviors

Adults with stuttering tend to anticipate moments of stuttering during the course of their speaking. This results in increase in anxiety, fear and secondary behaviors. The anxiety and tension are largely in anticipation of stuttering which, in fact, can make stuttering all the more likely to occur in that particular situation. Secondary behaviors/ coping mechanisms are reactions to one's stuttering to end them quickly or avoid them. These gradually become well-learnt patterns/strategies exhibited by the person who stutters. These can vary with age and severity of stuttering. Each person's secondary behavior may be different based on his/her individual preferences in coping with stuttering.

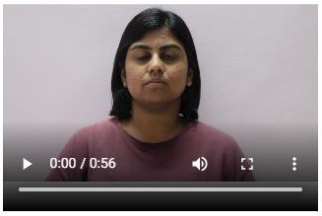
A person with stuttering might have a tendency to either escape from stuttering or avoid stuttering (escape-avoidance conflict).

Some of the coping mechanisms used to escape or avoid stuttering may be:

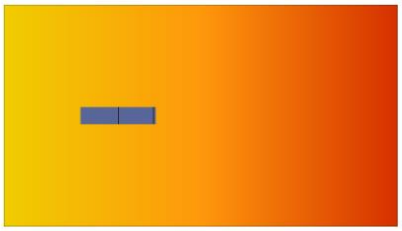
1. Terminating the words/ sentences as fast as possible resulting in short or incomplete sentences

2. Eye blinks, nose flaring and facial grimaces

Demonstration of the Technique



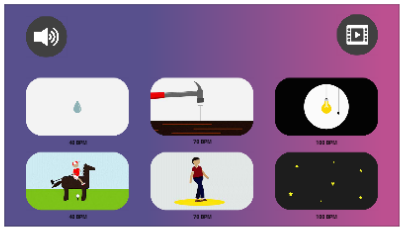
Animation



Instructions for using the animation:

- *Use "right arrow" key to move ahead as you speak fluently while touching the finger one after the other.*
- *Hold the "right arrow key" to increase the contact time. This indicates that there is ongoing dysfluency.*

Animation



Instructions for using the animation:

- *Clicking on any image will play that clip.*
- *The person has to speak one syllable/word to the beat simultaneously.*
- *The volume button on the top left will mute/unmute the clips (for the presence or absence of the auditory feedback).*
- *Clicking on the video button on the top right will set the video to play or not play (for the presence or absence of the visual feedback).*
- *Right click at any time to go back to menu.*