Reduction of Speech Disfluencies Through Online Awareness Training

By

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Abstract

Public speaking in a virtual format is becoming increasingly common given the rise in online education programs and changes necessitated by COVID-19 (Gupta et al., 2021). Therefore, it is important to establish a teaching procedure that is effective for increasing public speaking skills during virtual speeches. One method that has been successful in reducing speech disfluencies during in-vivo speeches is awareness training (e.g., Mancuso & Miltenberger, 2016; Ortiz et al., 2022). We extended previous literature by examining the effects of awareness training delivered online via a video conferencing program on rate of targeted speech disfluencies during virtual speeches. Additional measures were assessed during the study including untargeted speech disfluencies, self and external ratings of public speaking skills and confidence pre- and post-awareness training, self-reported anxiety pre- and post-awareness training, and social validity. Three female graduate students participated in the study. During baseline, all three participants demonstrated moderate to high rates of speech disfluencies during baseline. Following awareness training, all participants engaged in a significant decrease in rate of targeted speech disfluencies that maintained in the presence of a small audience and over a two-week period. Additionally, two participants maintained a low rate of speech disfluencies during a speech delivered during a professional seminar.

Key words: awareness training, habit reversal, public speaking, speech disfluency

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Reduction of Speech Disfluencies Through Online Awareness Training

Public speaking as an important for dissemination of research and one's own academic success (Friman, 2014). Skillful public speaking (e.g., effective storytelling, low rates of speech disfluencies) can lead audiences to perceive the speaker as more competent whereas poor public speaking can lead audiences to perceive the speaker as incompetent and less of an authority on their subject (Sereno & Hawkins, 1967). Furthermore, courses in higher education (e.g., doctoral programs) often require public speaking in various contexts such as presentations in the classroom or at conferences (Nash et al, 2016). Additionally, skillful speaking is important for one's career growth such as job interviews (Stocco et al., 2017).

Although public speaking is an important skill, it is not innate. Public speaking is a complex skill set that an individual must learn and practice to increase the overall quality and effectiveness of their speaking (Heinicke et al., 2022). Researchers have suggested certain public speaking behaviors lead to more effective public speaking. In behavior-analytic literature, Friman (2014) provided recommendations for effective public speaking which included standing straight, smiling, and speaking in the appropriate tone or volume for the topic. Heinicke and colleagues (2022) expanded upon these recommendations by interviewing 10 of the most frequently invited public speakers in the field of behavior analysis and analyzing their responses to interview questions about public speaking. Additional suggestions for effective public speaking included varying tone, delivering the speech in an authentic tone, using hand gestures effectively, and making eye contact with the audience. It should be noted, these behaviors are currently suggestions as the research pool on specific public speaking behaviors and how they affect the perceived effectiveness of a speaker is still quite small.

Researchers have targeted various behaviors to increase an individual's skillfulness in public speaking. For example, Fawcett and Miller (1975) increased preferred public speaking behaviors (e.g., eye contact, requesting questions) with four participants using an instructional package consisting of written instructions and behavior rehearsal. This package was effective in increasing preferred public speaking behaviors during the opening (i.e., before the scripted presentation) and closing (i.e., after the scripted presentation) portions of public speaking opportunities. Researchers have also attempted to decrease inappropriate public speaking behaviors, such as speech disfluencies, which include the use of nonsense syllables (e.g., "um," "er"), humming, inappropriate use of words such as "like," tongue clicking, and repetition of words or phrases in close succession (e.g., Mancuso & Miltenberger, 2016; Montes et al., 2019; Spieler & Miltenberger, 2017).

One procedure that has been effective at increasing speech quality by decreasing speech disfluencies is habit reversal. Habit reversal, now referred to as habit reversal training (HRT; Piacenti & Chong, 2005), was originally developed by Azrin and Nun (1973) with the purpose of decreasing nervous habits and tics. First, the learner is exposed to an awareness training in which they are made aware of the habit or tic. Awareness training can be done in a variety of ways such as using a mirror or video in which the individual observes their own behavior as it occurs or by recruiting the assistance of another individual in which the individual signals the occurrence of the behavior to the learner as it occurs. Second, the learner is taught a specific response that competes with the behavior targeted for reduction through competing response training (Azrin & Nun, 1973). HRT has been effective in treating a variety of behaviors such as tics (e.g., Azrin et al., 1980b; Himle et al., 2006), nail biting (e.g., Miltenberger at al., 1998), anger outbursts during

athletic performance (e.g., Allen, 1998), and speech disfluencies (e.g., Mancuso & Miltenberger, 2016).

Mancuso and Miltenberger (2016) recruited six female college students and evaluated the effectiveness of HRT in reducing speech disfluencies that occurred during short, 3 to 5 min, speeches using a nonconcurrent multiple baseline design across participants. Speech disfluencies were defined as the vocalizations "uh," "um," or "er;" clicking sounds; and misuse of the word "like." Intervention consisted of video awareness training in which the participant practiced recognizing the disfluencies while watching a 3-min video recording of their speech and raising their right hand to signal observation of a disfluency. Next, participants practiced identifying disfluencies in an identical fashion while giving a speech by raising their right hand when they engaged in a disfluency. Finally, during competing response training participants were trained to engage in behaviors that were incompatible with the targeted disfluencies (e.g., placing the tongue against the inside of the bottom teeth for 3 s). If a significant decrease in disfluencies was not observed following HRT, then participants were exposed to a booster training session that was identical to HRT but excluded video awareness training. It should be noted that one participant required a booster session. A follow-up session was held 2 to 5 weeks after the last post-intervention session to assess maintenance of skills. During baseline, participants engaged in a moderate to high rate of speech disfluencies *(M* = 7.4); however, following HRT, participants engaged in a significantly decreased rate of speech disfluencies (*M* = 1.4), which maintained 2 to 5 weeks following the last post-intervention session. This reduction of filled pauses suggests HRT was effective in reducing the rate of filled pauses during public speaking. Mancuso and Miltenberger noted that all participants showed a marked decrease in target

behaviors after video awareness training alone and suggested researchers explore the effects of awareness training alone to decrease speech disfluencies.

Spieler and Miltenberger (2017) extended previous research by evaluating a modified HRT procedure that consisted solely of awareness training, excluding competing response training. Four university students completed an awareness training that replicated Mancuso and Miltenberger (2016). Specifically, participants gave short speeches and then were trained to identify targeted disfluencies (i.e., filled pauses, tongue clicking, inappropriate use of the word "like") in a video of their speech and while giving a new speech. Spieler and Miltenberger also conducted booster sessions, which were identical to Mancuso and Miltenberger. Additionally, Spieler and Miltenberger extended previous research by conducting generalization probes to assess if treatment effects generalized to a small audience of five individuals. All participants, after exposure to awareness training, showed a significant decrease in speech disfluencies. This decrease maintained in front of the small audience; however, baseline performance was not measured in front of a small audience, limiting what can be said about generality. Additionally, all participants required a booster session to achieve the mastery criterion of a 75% reduction in disfluencies. Social validity scores indicated all participants found the treatment acceptable and noticed an overall improvement in their public speaking abilities, indicating an effective and acceptable intervention for increasing public speaking skills. Spieler and Miltenberger additionally noted competing response training may not be necessary given the significant decrease in speech disfluencies following awareness training alone.

Replicating the methods of Mancuso and Miltenberger (2016) and Spieler and Miltenberger (2017), Montes and colleagues (2019) recruited four undergraduate psychology students and implemented awareness training in two phases (i.e., video, in-vivo) to target speech

disfluencies for reduction. Additionally, Montes and colleagues recorded frequency of untargeted behaviors (i.e., silent pauses, repetition of words or phrases, and humming) during speeches to examine collateral effects and whether the training generalized to untargeted behaviors. Montes and colleagues found awareness training reduced targeted speech disfluencies to below 75% of baseline levels among all four participants. Furthermore, researchers found the effects of awareness training had varied results on the untargeted behaviors. After awareness training, there was a slight increase in the untargeted behaviors for two participants. For one participant, humming and repetitions decreased. Finally, for one participant, repetitions and humming covaried with targeted speech disfluencies suggesting the awareness training may have led to a decrease in untargeted behaviors for that participant. Overall, results suggested awareness training may be an effective intervention to decrease target behaviors but may not be effective at reducing behaviors that are similar but not directly targeted.

Although the effectiveness of awareness training in reducing speech disfluencies during in vivo speeches has been replicated across studies (Pawlik & Perrin, 2020; Perris et al., 2021), it is unclear the extent to which awareness training would be effective during virtual speeches. Research on the effectiveness of virtual awareness training is limited. Ortiz and colleagues (2022) examined the effectiveness of awareness training implemented remotely via teleconferencing programs with nine college students. Specifically, Ortiz and colleagues conducted a component analysis in which awareness training consisted of three stages: response description, video training, and in vivo training. Extending previous research, Ortiz and colleagues targeted a single speech disfluency at a time, whereas previous research targeted multiple disfluencies. During response description, participants were provided a description of the targeted speech disfluency along with an experimenter model of the speech disfluency. Video

training differed slightly from previous studies in that the participant observed a 1-min video while identifying the targeted speech disfluency. In vivo training was identical to video training with the exception that participants were now required to raise their hand while completing a 3-5 min speech, rather than while observing a video. Results of this study demonstrated that it was possible to reduce speech disfluencies via remote awareness training; however, varying levels of awareness training were necessary for each participant. Specifically, response description was sufficient for four participants, video training was necessary for two participants, and in-vivo training was necessary for three participants.

In the United States, there are 223 verified course sequence programs that meet the coursework requirements for individuals to sit for the Behavior Analyst Certification Board's certification exams. Of those programs, 69% offered some form of online coursework (e.g., online programs, hybrid programs; Dubuque & Kazemi, 2021). As online programs become more prevalent, so too does the opportunity to engage in public speaking in virtual formats. Additionally, during the COVID-19 pandemic, many schools and professional conferences (e.g., Association for Behavior Analysis International) moved to remote attendance in which classes and presentations were conducted over video conferencing programs (e.g., Zoom). Given the effectiveness of awareness training, the increase in the number of online programs, and the changes necessitated by the COVID-19 pandemic, public speaking in a virtual format is becoming increasingly common. Thus, it is important to also establish teaching procedures for training individuals on best public speaking practices that are effective during virtual speeches. Therefore, the purpose of this study was to replicate and extend the methods of Montes and colleagues (2019) during virtual speeches and extend the findings of Ortiz and colleagues (2022)

by examining whether targeted speech disfluencies generalize to larger audiences following remote awareness training.

Methods

Participant, Setting, and Materials

Three graduate students were recruited from a large midwestern university via recruitment emails. Isabella and Tatiana were female master's students, and Katherine was a female doctoral student. All participants were studying applied behavior analysis and were interested in improving their public speaking skills. Participants attended 1-hour blocks two to three times per week via Zoom, an online video conferencing application. Prior to each 1-hour block, the experimenter sent the participant a link via email to a password protected virtual meeting room. With the consent of the participant, all sessions were recorded via Zoom.

Given the remote nature of the study, participants were required to have access to internet and a personal computer with a microphone, speakers, and camera. Materials included paper and pen for data collection, colored cards to signal specific times in the speech, a list of general speech topics (Appendix A), a stopwatch, a self-rating public speaking ability and confidence survey (e.g., "How confident are you when speaking publicly?"; Appendix B), a social validity survey consisting of questions related to the acceptability of the intervention (e.g., "How acceptable was the intervention?"; Appendix C), an external rating public speaking abilities and confidence survey (Appendix D), and the Public Speaking Anxiety Scale (Bartholomay & Houlihan, 2016; Appendix E).

Response Measurement, Interobserver Agreement, and Treatment Integrity

Trained data collectors recorded the frequency of targeted speech disfluencies, untargeted speech disfluencies, and hand raising. The primary dependent variables were speech

disfluencies: filled pauses (e.g., “um,” “huh”), tongue clicking (i.e., the press and subsequent release of the participant’s tongue on the roof of their mouth resulting in an audible click sound), and inappropriate interjections of the word “like” (e.g., “I like went to work.”). The dependent measure was the combined rate of these three speech disfluencies. To calculate the combined rate of targeted speech disfluencies per minute, the frequencies of all target behaviors recorded during the speech were summed and divided by the total length of the speech in minutes to calculate the rate of disfluencies per minute for each speech. Untargeted speech disfluencies were silent pauses (i.e., an absence of speech or sounds for at least 2 s), repetition of words or phrases (i.e., interrupting a sentence to vocally repeat a word or a set of words), and humming (i.e., steady sound emitted from a closed mouth for at least 1 s). Data collection and analysis were the same as targeted speech disfluencies. Additionally, during proseminar generalization, data collectors recorded targeted and untargeted speech disfluencies during a randomly selected 5 min.

During awareness training, trained data collectors recorded data on accurate right-hand raises. An accurate right-hand raise was defined as the participant raising their right hand within 1 s of emitting a targeted speech disfluency (i.e., filled pauses, tongue clicking, inappropriate use of the word like). A prompted right-hand raise was defined as the participant raising their right hand after the researcher raised their right hand. Researchers then calculated the percentage of accurate right-hand raises during each speech. This was done by dividing the number of accurate hand raises by the total number of opportunities for right-hand raises and multiplying the quotient by 100 to yield a percentage. Frequency data were also collected on left-hand raises, though this behavior was not scored as correct or incorrect (see Awareness Training below).

A second, independent observer collected data on targeted disfluencies, untargeted disfluencies, and right-hand raises for an average of 51% (range, 43%-62%) of sessions for each participant using recordings of sessions. A proportional method was used to calculate interobserver agreement (IOA) for targeted and untargeted speech disfluencies. IOA for targeted and untargeted speech disfluencies was calculated by summing the quotient of each interval (i.e., smaller frequency recorded divided by larger frequency recorded), dividing by the total number of intervals, and multiplying by 100. Finally, to calculate IOA for accurate right-hand raises, the total number of agreements (i.e., both observers recording the occurrence or nonoccurrence of an accurate right-hand raise) was divided by the sum of agreements and disagreements and multiplied by 100. IOA was calculated for 43% of sessions for Isabella, 62% of sessions for Tatiana, and 48% of sessions for Katherine. For Isabella, mean agreement was 96% (range, 75%-100%) for targeted speech disfluencies, 95% (range, 75%-100%) for untargeted speech disfluencies, and 96% (range, 95%-100%) for accurate right-hand raises. For Tatiana, mean agreement was 92% (range, 85%-100%) for targeted speech disfluencies, 96% (range, 80%-100%) for untargeted speech disfluencies, and 92% (range, 89%-94%) for accurate right-hand raises. For Katherine, mean agreement was 91% (range, 80%-100%) for targeted speech disfluencies, 88% (range, 80%-100%) for untargeted speech disfluencies, and 89% (range, 78%-100%) for right-hand raises.

Treatment integrity was scored for 49.33% (range, 43%-62%) of sessions across all phases and participants. First, experimenter implementation of procedures was scored using the treatment integrity checklists develop by Mancuso and Miltenberger (2016) for baseline and assessment (Appendix F), awareness training – video (Appendix G), and awareness training – in vivo (Appendix H). The baseline and assessment treatment integrity checklist was utilized during

baseline, awareness training posttest, generalization probes, and maintenance sessions and evaluated steps such as providing the participant with choices of speeches, allowing time for the outline, and ensuring the speech was an appropriate length. The awareness training – video checklist was utilized solely during video training and consisted of questions related to discussing the topography of the target behaviors, practicing identification of the behavior in a video clip, and accuracy of the primary investigator raising their hand after observation of a speech disfluency. Finally, the awareness training – in vivo checklist was utilized solely during in vivo awareness training and consisted of questions related to providing a choice between topic, allowing time to create an outline, accuracy of the primary investigator raising their hand 1 s after observation of a disfluency, and ensuring the speech was an appropriate length via the use of time warnings (i.e., colored card signifying 1 min remaining and the end of the speech). A trained data collector recorded data by circling yes or no depending on whether the primary experimenter exhibited certain behaviors. Treatment integrity of experimenter implementation of procedures was calculated for 43% of sessions for Isabella, 57% of sessions for Tatiana, and 48% of sessions for Katherine. Treatment integrity was 100% for experimenter implementation of procedures during baseline and assessment for Isabella, Tatiana, and Katherine. For video training sessions, mean treatment integrity was 92% (range, 75%-100%) for Isabella and 100% for Tatiana and Katherine. Finally, treatment integrity during in vivo awareness training was 96% (range, 87%-100%) for Isabella and Tatiana, and 100% for Katherine.

IOA of treatment integrity scores was calculated for 100% of speeches in which treatment fidelity was measured. To calculate IOA for experimenter implementation of procedures, a second, independent observer collected data using the implementation fidelity checklist for baseline and assessment (Appendix F), video awareness training (Appendix G), and

in vivo awareness training (Appendix H). An agreement was scored when both observers recorded the same response (i.e., yes or no). IOA was calculated by summing the number of agreements between the two observers, dividing by the sum of agreements and disagreements, and multiplying by 100. Mean agreement across all participants was 100% for baseline and assessment procedures, 96% (range, 95%-100%) for video awareness training procedures, and 97% (range, 97%-100%) for in vivo awareness training procedures.

Procedure

Social Validity Measures

Each participant completed three surveys in total. First, the participant was asked to complete a survey to rate their public-speaking ability and confidence. This survey contained five questions related to the participant's own confidence in public speaking (e.g., "How comfortable are you with public speaking?") and was provided to the participant at the onset of the experiment and after the completion of the maintenance probe. Second, the participant completed the Public Speaking Anxiety Scale (Bartholomay & Houlihan, 2016) in which the participant rated how true 17 statements were related to their social anxiety specific to public speaking (e.g., "Public speaking is terrifying") on a scale of one to five (i.e., 1: not at all, 2: slightly, 3: moderately, 4: very, and 5: extremely). This survey was also completed at the onset of the experiment and after completion of the maintenance probe. Finally, after completion of the maintenance probe, the participant completed a social validity survey containing six questions aimed at assessing acceptability of the intervention (e.g., "How much did you like the habit reversal procedure?") and perceived effectiveness of the intervention (e.g., "How effective was the intervention in terms of reducing your use of fillers or nervous mannerisms?"; Mancuso & Miltenberger, 2016; Montes et al., 2019; Spieler & Miltenberger, 2017). All survey items,

excluding the Public Speaking Anxiety Scale, were ranked on a five-point Likert scale where scores closer to 5 indicated greater public speaking ability and treatment acceptability.

A graduate research assistant completed two separate external rating surveys for a randomly selected baseline and post-intervention speech for each participant. The external rating survey consisted of questions related to the speaker's perceived comfort (e.g., "The speaker appeared nervous.") and public speaking skills (e.g., "The speaker spoke at an appropriate rate." "The speaker used fillers, such as um, ah, or er."). This graduate research assistant ranked each question using a five-point Likert scale where scores closer to 5 indicated greater public speaking ability. The graduate research assistant was blind to experimental conditions.

Baseline

During baseline, participants met individually with the researcher. Upon entering the meeting, each participant was informed they would be presented with topics on which to give a speech. The researcher then provided the participant with two randomly selected speech topics from which to choose. After the participant had chosen one of the two speech topics, the experimenter allowed the participant 5 min to create an outline to use during the speech. The researcher did not give any guidelines for creating the speech outline. Once 5 min had elapsed or if the participant completed the outline in less time and indicated readiness, the researcher instructed the participant to start their speech by stating, "You can start." Throughout the speech, the experimenter maintained a neutral expression (e.g., refrained from nodding, smiling, frowning) regardless of participant performance. If the participant attempted to end the speech before 3 min elapsed or if the participant stopped talking for longer than 15 s, the researcher prompted the participant to, "please continue." At 4 min into the speech, the experimenter held up a white card to signal 1 min remained. At 5 min, the experimenter held up a red card to signal

the end of the speech. Speeches ended after 5 min elapsed or when the participant ended the speech following at least 3 min. At the end of the speech, the experimenter thanked the participant using a neutral tone.

Awareness Training

Awareness training consisted of two phases, video and in vivo training. First, participants completed video training to mastery. Second, participants completed in vivo training to mastery. Mastery criteria for both video and in vivo training was 85% correct hand raises for two consecutive speeches or 100% correct responding in one speech (Montes et al., 2019).

Video Training. Video training was identical to Montes and colleagues (2019). Participants met with the primary researcher who defined and identified the targeted disfluencies. Next, the participant was instructed to raise their right hand each time they observed a disfluency in the video. The participant then watched the first 3 min of a randomly selected video of a baseline speech and practiced identifying the disfluencies in their speech. The same video was used throughout the video training phase. The experimenter also raised their right hand following a disfluency in the video, though the experimenter waited 1 s after hearing the disfluency before raising their hand to allow the participant to independently raise their hand in the absence of experimenter prompts.

In Vivo Training. In vivo training was similar to baseline; however, prior to preparing a speech outline, the experimenter reviewed the targeted disfluencies and instructed the participant to raise their right hand when they engaged in a speech disfluency while giving the speech. The participants were also instructed to raise their left hand when they felt the urge to engage in a disfluency, even if one was not emitted. During the speech, the experimenter also raised their right hand after each disfluency. The same speech was used throughout in vivo training.

Awareness Training Posttest

Awareness training posttest was conducted once participants met the mastery criteria in video training and in vivo training. Sessions were identical to baseline. This phase continued until stability criteria were met and the participant displayed at least a 75% reduction in speech disfluencies from baseline.

Generalization Probes

Generalization probes were conducted pre- and post-intervention to examine if reduction of the targeted speech disfluencies maintained in front of a small audience. Sessions were similar to baseline; however, the participant presented a 5-min speech in front of a small audience of five to six individuals consisting of graduate students and a faculty member. Audience members were instructed to maintain attention on the speaker and maintain a neutral expression (i.e., refrain from smiling, nodding, frowning, or reacting to the speaker in any way) throughout the speech.

Proseminar Generalization Probe

For two participants, a second generalization probe was conducted during a professional seminar with the participant's consent. Professional seminars were a degree requirement for all recruited graduate students. A professional seminar is typically a 30-min speech for master's-level students or a 50-min speech for doctoral-level students. This speech was conducted in front of a large audience that varied in size depending on attendance. Given COVID-19, all professional seminar speeches were delivered via Zoom. Isabella completed a 30-min speech, and Katherine completed a 50-min speech.

Maintenance Probe

Maintenance probes were conducted to examine if reduction of the targeted speech disfluencies maintained at least 2 weeks after posttests. Sessions were identical to baseline.

Design

Due to the potential irreversibility of the intervention, a nonconcurrent multiple baseline design across participants was used to evaluate the effects of awareness training on speech disfluencies during online public speaking opportunities (Watson & Workman, 1981). Baseline and awareness training posttests ended when the participants' disfluencies were considered stable (i.e., three consecutive sessions with no evidence of trend and minimal variability). To demonstrate experimental control, baseline lengths and the introduction of awareness training were staggered across participants such that changes in participant behavior could be evaluated in relation to the introduction of awareness training.

Results

Figure 1 depicts the targeted disfluency data for Isabella (top panel), Tatiana (middle panel), and Katherine (bottom panel). Speeches are scaled to the x-axis, and the rate of targeted speech disfluencies is scaled along the y-axis. The closed circles depict the rate of disfluencies during baseline and awareness training posttest sessions, closed squares depict generalization probes, open circles depict maintenance probes, and open squares depict proseminar generalization probes. The dotted horizontal line depicts mastery criteria for each participant. During baseline, Isabella completed three speeches during which she engaged in a low to moderate level of targeted disfluencies and a slight decreasing trend (M = 3.38 disfluencies/min). During the generalization probe, Isabella engaged in a higher level of targeted disfluencies (5 disfluencies/min). During awareness training posttests, the level of targeted disfluencies

immediately decreased below mastery criteria (.84 disfluencies/min) and maintained at a low level (*M* = .20 disfluencies/min) for six speeches within minimal variability (range, .2 – 1 disfluencies/min). During the generalization probe, the rate of targeted disfluencies increased above mastery criteria but remained lower than baseline levels (1.4 disfluencies/min). During the maintenance probe, the rate of targeted disfluencies decreased to post-awareness training levels (.4 disfluencies/min). Finally, during the proseminar generalization, the rate of targeted disfluencies remained low (0 disfluencies/min).

During baseline, Tatiana completed six speeches during which she engaged in a moderate to high level of targeted disfluencies and a stable trend (*M* = 6.50 disfluencies/min). During the generalization probe, Tatiana engaged in a higher level of targeted disfluencies (8.87 disfluencies/min). During awareness training posttests, the level of targeted disfluencies immediately decreased below mastery criteria (1.63 disfluencies/min) and maintained at a low level (*M* = .38 disfluencies/min) for four speeches within minimal variability (range, 0 – 1.12 disfluencies/min). During the generalization probe, the rate of targeted disfluencies increased but remained below mastery criteria (1 disfluency/min). During the maintenance probe, the rate of targeted disfluencies maintained at post-awareness training levels (1 disfluency/min).

Finally, during baseline, Katherine completed nine speeches during which she engaged in a moderate to high level of targeted disfluencies and a slight decreasing trend (*M* = 9 disfluencies/min). During the generalization probe, Isabella engaged in a higher level of targeted disfluencies (6 disfluencies/min). During awareness training posttests, the level of targeted disfluencies immediately decreased below mastery criteria (2.25 disfluencies/min) and maintained at a low level (*M* = .11 disfluencies/min) for four speeches within minimal variability (range, 0 – .44 disfluencies/min). During the generalization probe, the rate of targeted

disfluencies increased but remained below mastery criteria (1.4 disfluencies/min). During the maintenance probe, the rate of targeted disfluencies decreased to the post-awareness training level (.21 disfluencies/min). Finally, during the proseminar generalization, the rate of targeted disfluencies remained low (.6 disfluencies/min).

Figure 2 depicts the untargeted disfluency data for Isabella (top panel), Tatiana (middle panel), and Katherine (bottom panel). Graphing conventions are the same as Figure 1. During baseline, Isabella completed three speeches during which she engaged in a low level of untargeted disfluencies with minimal variability (*M* = .69 disfluencies/min). During the generalization probe, Isabella engaged in a low level of untargeted disfluencies (.5 disfluencies/min). During awareness training posttests, the level of untargeted disfluencies maintained at similar level, albeit slightly higher level than baseline (*M* = .74 disfluencies/min) for six speeches within minimal variability (range, .2 – 1.24 disfluencies/min). During the generalization probe, the rate of untargeted disfluencies decreased (.4 disfluencies/min). During the maintenance probe, the rate of untargeted disfluencies maintained at post-awareness training levels (.6 disfluencies/min). Finally, during the proseminar generalization, the rate of targeted disfluencies remained low (.2 disfluencies/min).

During baseline, Tatiana completed six speeches during which she engaged in low levels of targeted disfluencies with minimal variability (*M* = .74 disfluencies/min). During the generalization probe, Tatiana engaged in a higher level of untargeted disfluencies (2 disfluencies/min). During awareness training posttests, the level of targeted disfluencies maintained at a low level (*M* = .52 disfluencies/min) for four speeches with minimal variability (range, .6 – 2 disfluencies/min). During the generalization and maintenance probe, the rate of untargeted remained at a similar level (1 disfluencies/min, .6 disfluencies/min, respectively).

Finally, during baseline, Katherine completed nine speeches during which she engaged in low levels of untargeted disfluencies and minimal variability (*M* = .56 disfluencies/min). During the generalization probe, Isabella engaged in a lower level of untargeted disfluencies (.22 disfluencies/min). During awareness training posttests, the level of targeted disfluencies increased slightly but maintained at a low level (*M* = .96 disfluencies/min) for four speeches within minimal variability (range, .71 – 1.18 disfluencies/min). During the generalization probe, the rate of untargeted disfluencies maintained at post-awareness training levels (1.05 disfluencies/min). During the maintenance probe, the rate of untargeted disfluencies decreased but maintained at similar levels (.84 disfluencies/min). Finally, during the proseminar generalization, the rate of targeted disfluencies remained low (.2 disfluencies/min).

Table 1 depicts the self-rating results of the public speaking abilities and confidence surveys prior to and following intervention. The table displays the mean across participants with ranges in parentheses. Additionally, the last column displays the average difference (i.e., change in score) across participants. Prior to awareness training, participants reported their comfort level as uncomfortable (2.33, range, 1-4), overall ability as less than average (2.33, range, 2-3), confidence level as not confident (2, range, 1-3), use of fillers as often (2.33, range, 1-4), and anxiety level as anxious (2.67, range, 1-5). Following awareness training, participants rated their comfort level as somewhat comfortable (3.33, range, 3-4, difference, +1), overall ability as average (2.33, range, 2-3, difference, +.33), confidence level as not confident (2.67, range, 1-4, difference, +.67), use of fillers as sometimes (3.33, range, 3-4, difference, +1), and anxiety level as anxious (2.67, range, 1-4, difference, 0).

Additionally, Table 1 depicts the external-rating results of the public speaking abilities measure. Prior to awareness training participants were rated to appear comfortable (4.3, range 3-

5), use appropriate voice projection (5), speak at an appropriate rate (4.3, range 3-5), make appropriate levels of eye contact (5), speak somewhat fluently (3.33, range 2-5), appear mildly nervous (2.3, range 1-4), use appropriate levels of movement (4, range, 3-5), appear somewhat out of breath (2.33, range 1-4), use appropriate gestures (4.33, range 3-5), use filler words and sounds (3, range, 1-4), appear confident (3.67, range 2-5), and speak with an average ability overall (3.67, 3-5). Following awareness training, participants were rated to appear comfortable (4.33, range 3-5, difference, -.3), use appropriate voice projection (4.67, range 4-5, difference, -.3), speak at an appropriate rate (4.3, range 3-5, difference, 0), make appropriate levels of eye contact (4.33, range 3-5, difference -.67), speak fluently (4.33, range 4-5, difference, +1), appear mildly nervous (2.67, range 1-4, difference, +.34), use appropriate levels of movement (3.67, range, 2-5, difference, -.33), appear somewhat out of breath (2, range 1-3, difference, -.33), use appropriate gestures (4, range 2-5, difference, -.33), use less filler words and sounds (2, difference, -1), appear confident (3.67, range 2-5, difference, 0), and speak with an above average ability overall (4, 3- 5, difference, +.33).

Results of the Public Speaking Anxiety Scale (Bartholomay & Houlihan, 2016) are displayed in Table 2. The table displays the mean score across participants with ranges in parentheses during baseline and post-awareness training. Additionally, the last column displays the average difference (i.e., change in score) across participants. Prior to awareness training, participants rated giving a speech as slightly terrifying (2.67, range 2-3); had a fear they would be at a loss for words (3.67, range, 3-5); were nervous they would embarrass themselves (4, range, 2-5); were unable to refocus when they made a mistake (2.67, range 2-3); worried the audience would think they were a bad speaker (4, range, 2-5); were focused on what they said (4.67, range, 4-5); felt not confident (2, range 1-3); did not feel satisfied after the speech (2,

range 1-3); stated their hands shake when delivering a speech (2.33, range 1-3); felt slightly sick when giving a speech (2.67, range 1-5) and tense before giving a speech (4, range, 3-5); fidgeted before giving a speech (3.67, range, 2-4); reported their hearts pound when speaking (3.67, range 2-4), they sweat slightly during speeches (3, range, 1-4), and their voice slightly trembled (2, range, 1-3); did not feel relaxed when speaking (1), and had a moderate problem making eye contact (1.67, range 1-3). Once items had been reverse coded, the overall score for baseline was 52.01. Following awareness training, participants rated giving a speech as slightly terrifying (2.33, range 2-3, difference, -.33); had a moderate fear they will be at a loss for words (3.33, range, 2-5, difference, -.33); were slightly nervous they will embarrass themselves (2.67, range, 1-5, difference, -1.33); were able to refocus when they make a mistake (3, range 2-5, difference, +.33); worried that the audience will think they are a bad speaker (1.67, range, 1-2, difference, -2.33); were focused on what they say (4, range 3-5, difference, -.33); were slightly confident (2.33, range, 1-3, difference, +.33); felt moderately satisfied after the speech (3, range, 1-4, difference, +1); stated their hands shake slightly when delivering a speech (2.33, range, 1-2, difference, -1); felt slightly sick when giving a speech (2, range, 1-4, difference, -.33) and moderately tense before giving a speech (3, range 2-4, difference, -1); fidgeted before a speech (3.67, range, 3-4, difference, 0); reported their hearts pounded when speaking (3, range, 2-4, difference, -.33), they sweat slightly during speeches (2.67, range, 2-3, difference, -.33), and their voice slightly trembled (2, range, 1-3, difference, 0); did not feel relaxed when speaking (1.67, range, 1-2, difference, +.33); and had a slight problem making eye contact (3, difference, +2.33). Once items had been reverse coded, the overall score for post-awareness training was 41 (difference, -11.01).

Table 3 depicts the social validity survey results. Two of the three participants (Tatiana and Katherine) returned a social validity survey. Both participants reported the training was acceptable (5), they were willing to participate (5), there were few possible disadvantages (4.5, range, 4-5), there was little difficulty in participating (4.5, range, 4-5), they liked the procedures (4), and rated them as effective (4).

Discussion

The purpose of the current study was to systematically replicate and extend the awareness training of Montes and colleagues (2019) and extend the findings of remote awareness training (Ortiz et al., 2022) during virtual speeches and examine generalization of training effects. Overall, remote awareness training decreased targeted speech disfluencies in all three participants during virtual speeches. This finding is similar to previous research (e.g., Spieler & Miltenberger, 2017; Montes et al., 2019) and extends the evidence on the effectiveness of remotely delivered awareness training (Ortiz et al., 2022). Unlike other studies (e.g., Mancuso & Miltenberger, 2016), participants in the current study did not necessitate a booster session, and speech disfluencies maintained at low rates during generalization and maintenance probes. For two participants, a more ecologically valid generalization probe was conducted, and speech disfluencies maintained at a low level.

Awareness training was effective in reducing targeted speech disfluencies for all three participants. Awareness training may be effective for several different reasons. First, rule governance may play a role in the reduction of speech disfluencies (Miltenberger et al., 1998). Specifically, during awareness training, participants may establish a rule that in the presence of an audience, they prompt themselves to engage in a competing response (e.g., pausing) to refrain from engaging in the target behavior. Second, self-imposed punishment may play a

complimentary role to this rule governed behavior. It is possible that rule governed behavior led to self-imposed punishment by the participant engaging in alternative behaviors to the speech disfluencies (Miltenberger et al., 1998) to avoid engaging in the target behaviors. Interestingly, after video training was complete, all three participants noted experiencing some form of discomfort in observing their own behavior and particularly the frequency of disfluencies they observed. This could suggest that engaging in the disfluencies themselves developed aversive properties after observing them in the video portion of awareness training, motivating the participants to engage in competing behaviors. Anecdotally, participants were observed to engage in competing responses (e.g., tightly closing the mouth, silent pauses) following awareness training that were not observed during baseline speeches. Third, during awareness training, the experimenter also raised their hand. It is also possible that observing the experimenter raise their hand before the participant, signaled an error to the participant and thus paired the target behaviors further with aversive stimuli. Avoidance of these aversive stimuli via raising their hand first or refraining from speech disfluencies may negatively reinforce competing responses in which the participant may have engaged (Skinner, 1953).

During maintenance probes, all participants engaged in low rates of the targeted disfluencies. This suggests that treatment effects maintained after reaching mastery criteria. Maintenance may have occurred due to aspects of the environment (e.g., the experimenter, Zoom) inadvertently gaining discriminative properties and becoming stimulus deltas for engaged in the targeted behaviors (Michael, 2000). Additionally, the targeted disfluencies may have become aversive stimuli as a result of the awareness training. As such, engagement in alternative behaviors would remove the aversive stimuli and result in negative reinforcement of alternative behaviors (Himle et al., 2006; Skinner 1953). Furthermore, maintenance was evaluated 2 weeks

after the last post-intervention probe which may not be representative of the natural length of time between public speaking opportunities. Researchers should evaluate the maintenance of skills across greater periods of time as this may be a more socially valid evaluation of maintenance of skills as it is possible the effectiveness of stimulus control may weaken across greater periods of time.

All three participants maintained a low rate of targeted disfluencies during generalization probes in the presence of a small audience (i.e., 4-5 individuals) following awareness training. During both generalization probes, all participants showed a slight increase in rate of speech disfluencies. Although rate of speech disfluencies increased during the second generalization probe for all participants, it maintained below mastery criteria for two of the three participants (Tatiana and Katherine) and lower than baseline rates for Isabella. These results suggest that the effects of remote awareness training will generalize to virtual speeches with a small audience. This may be due various aspects of the training gaining stimulus control. Specifically, the presence of the video conference program or the experimenter could have could have been established as a discriminative stimulus signaling the availability of negative reinforcement in the absence of speech disfluencies through pairing the program with the practice of observing the disfluencies (Michael, 2000).

In an attempt to evaluate a more ecologically valid virtual speech in front of a larger audience, we conducted proseminar generalizations with Isabella and Katherine. We were unable to conduct proseminar generalization for Tatiana given she was not scheduled to conduct one during the duration of the study. For Isabella, targeted speech disfluencies did not occur. While this may be because of the awareness training, there are other variables that may have affected disfluencies during this speech. First, Isabella presented her thesis research. This speech was

more scripted, and she had more opportunities to practice. Thus, it is possible that presentation preparation (e.g., repeated exposure to the same speech) and use of a script contributed to the zero rate of targeted speech disfluencies. Second, a 5-min sample of the proseminar speech was collected. It is possible that speech disfluencies occurred at other portions of the speech. For Katherine, speech disfluencies occurred at a low rate. Katherine presented her dissertation research. Similar to Isabella, Katherine had several opportunities to practice prior to the presentation, which may have led to lower rates of targeted speech disfluencies. Researchers should continue to evaluate how this training affects professional presentations by examining longer speeches, presentations, and imposing restrictions related to scripts. Additionally, while researchers should continue to look at generalization to larger audiences, those vested in the social validity of this training should examine the generalization of effects to various environments (e.g., workplace presentations, job interviews). Although these results are exciting, we did not examine generalization to other contexts (e.g., in-person presentations). It is possible responding may vary in these situations, necessitating training under those specific stimulus conditions.

When analyzing covariation of untargeted disfluencies, two of the three participants (Isabella and Katherine) showed a slight increase in behaviors. Although rate of untargeted disfluencies was low in this study, results are similar to Montes and colleagues (2019) and indicate that awareness training does not seem to generalize to non-targeted topographies. These findings are not surprising given previous research on collateral effects of HRT for other responses (e.g., Miltenberger et al., 1998). Researchers may want to explore the effects of delivering instructions or rules after the completion of awareness training to examine if participants could then generalize responding to untargeted behaviors. For example, a participant

who successfully decreased filled pauses (e.g., saying “um”) post-awareness training, may decrease humming during pauses when provided an example of the behavior and instructed to refrain from humming (e.g., Ortiz et al., 2022). It may be important to identify a training that results in generalized responding such that training does not need to be applied to each individual speech disfluency as this would be time intensive and laborious.

Participants completed a self-rating public speaking abilities and confidence survey. Overall, results suggested a slight increase in comfort and confidence amongst participants, though it should be noted the difference was little (range, 0-1). These results may be due to the complexity of public speaking and the fact that it is made of multiple skills. An increase in one skill, or a decrease in some behaviors, does not necessarily mean the speaker will be entirely competent or feel competent. Interestingly a speaking abilities and confidence survey completed by an external rater yielded varied results. While the external rater reported a slight increase in overall speaker ability, they rated participants as less comfortable and observed on average no change in confidence of the speakers. It should be noted, that for one of the speakers (Tatiana), the external rater reported high overall ability both pre- and post-awareness training. This suggests that there are other components to perceived speaker ability than just the number of speech disfluencies.

This study also included a public speaking anxiety survey in an attempt to examine the effects of awareness training on experienced anxiety as public speaking anxiety is among one of the most common forms of anxiety (Leary & Kowalsky, 1995). Overall scores suggest a decrease in experienced anxiety post-awareness training. To elaborate, 13 out of 17 total items were scored lower post-awareness training. These results suggest that the reduction of speech disfluencies may lead to a decrease in public speaking related anxiety. However, it is also

possible that repeated practice of public speaking throughout the study, and the resulting exposure, could have also contributed to decreased anxiety. It should be noted that the survey also consisted of items not specific to speech disfluencies (e.g., "If I make a mistake in my speech, I am unable to re-focus"). Interestingly, two items that were scored lower post-awareness training were related to focus (e.g., "I am focused on what I am saying during my speech"). This may suggest an increase in effort during public speaking to decrease target behaviors. This is supported by comments from participants after completing speeches during in vivo training in which participants noted it was difficult to focus on the speech and refrain from engaging in the speech disfluencies. While these results are interesting, it is important to note that the Public Speaking Anxiety Scale (Bartholomay & Houlihan, 2016) was that only anxiety measurement used in this study. Those interested in exploring the effects of decreased speech disfluencies on public speaking anxiety should determine if other forms of measurement are needed, such as the Beck Anxiety Inventory (Steer et al., 1993) which measures anxiety using a Likert scale and questions related to somatic and cognitive symptoms of anxiety. Additionally, researchers interested in public speaking anxiety should explore the effects of training of preferred public speaking behaviors (e.g., making eye contact, preparing speeches).

Tatiana and Katherine completed the social validity survey and rated awareness training as effective and acceptable. Specifically, on a 5-point Likert scale, both participants answered with "effective" when asked if they liked the treatment and thought it was effective. Additionally, both participants rated the treatment as acceptable and of low difficulty. These responses suggest that online awareness training may be a socially acceptable delivery method of awareness training. This method of delivery may be beneficial for those in more remote (e.g., rural) areas or those who experience barriers to travelling for training such as lack of access to

personal vehicles, lack of physical ability to drive, or lack of access to public transport. Further exploration should be done to better package awareness training to meet the need of individuals experiencing barriers who would still benefit from decreased speech disfluencies. Additionally, researchers could explore the possibility of an asynchronous treatment package in which the participant is recorded presenting speeches and completes awareness training that is delivered via instructions and individual practice with videos. If effective, this may be a more efficient method of training for professionals and employees at a large scale.

Some limitations of this study are worth noting. First, this study consisted of only graduate students in applied behavior analysis, leading to an uncertainty of how this procedure would generalize to other populations. Previous research has primarily evaluated awareness training with college students (e.g., Montes et al., 2019; Ortiz et al., 2022, Spieler & Miltenberger, 2017), and while various students (i.e., undergraduate, doctoral) have decreased their speech disfluencies via awareness training, it may be beneficial to explore non-academic populations. There are many opportunities for a behavior analyst to engage in public speaking (e.g., insurance authorization, parent and staff training), and researchers could explore these populations and contexts to further validate awareness training as an effective intervention. Second, this study was unable to examine the generalization of effects to public speaking opportunities that occurred in person. While attending and speaking at virtual conferences has increased recently, those who experience remote awareness training may still be required to speak in front of large audiences in person. During this study, participants spoke in front of various sized audiences during generalization probes, but they always presented from their personal computer at their home. It is unclear whether reductions in speech disfluencies would maintain during in-person speeches as the environment and stimuli present would be vastly

different (e.g., on a stage, ability to see the audience). For example, on some video conferencing platforms, the speaker is unable to see the audience and might be able to ignore their presence. Researchers interested in evaluating the effectiveness of awareness training as a treatment package should evaluate whether speech disfluencies maintain at a low rate under different and more ecologically valid conditions. Third, there were some challenges related to technology due to the online nature of this study. Specifically, the audio of the speaker occasionally cut out or lagged throughout the study, likely due to internet connection. While the researcher is not aware of any speech disfluencies occurring during these moments, it is possible that these breaks could allow targeted and untargeted speech disfluencies to have been missed for data collection throughout the study, thus varying the results. Researchers may attempt to control for these technological limitations by requesting participants to record themselves giving the speech with a separate device (e.g., video camera) at the same time to remove the possibility of connection issues.

Public speaking is a complex skill set made of multiple behaviors (Friman, 2014; Heinicke et al., 2022). As Friman (2014) suggested, to be an effective public speaker, it is recommended to prepare, make eye contact, and capture the attention of the audience, among other behaviors. While the pool of research surrounding awareness training and public speaking behaviors is growing (e.g., Montes et al., 2019; Ortiz et al., 2022), researchers would benefit from exploring other aspects of public speaking. Specifically, researchers may explore the extent to which awareness training may be applied to other speaking disfluencies (e.g., humming, speaking too quickly). Furthermore, as public speaking research expands to the applied setting, it could be beneficial for researchers to explore avenues of increasing the efficiency of awareness training packages. For example, researchers may wish to continue to explore the components of

awareness training and determine which components are necessary and which might cause the largest changes to create a more efficient training package (e.g., Montes et al., 2021; Ortiz et al., 2022).

Fluent public speaking is a valued skill, and past researchers have demonstrated that awareness training can be an effective method for decreasing speech disfluencies (e.g., Mancuso & Miltenberger, 2016; Montes et al., 2021; Spieler & Miltenberger, 2017). Similar to previous research, we found awareness training alone delivered via an online video conferencing program was an effective intervention without the use of booster sessions (Spieler & Miltenberger, 2017). Additionally, the success of an online format extends previous research towards a more diverse use of awareness training that may allow for broader dissemination of the training. Further examination of this method of implementation may help develop a more efficient and convenient treatment package for students and professionals.

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Table 1

Item	BL	Post-AT	Δ
Public speaking abilities and confidence (Self rating)			
Comfort Level	2.33 (1-4)	3.33 (3-4)	+1
Overall Ability	2.33 (2-3)	3.00 (3)	+.33
Confidence Level	2.00 (1-3)	2.67 (1-4)	+.67
Use of fillers	2.33 (1-4)	3.33 (3-4)	+1
Anxiety Level	2.67 (1-5)	2.67 (1-4)	0
Public speaking abilities (External rater)			
Comfortable appearance	4.30 (3-5)	4.00 (3-5)	-.3
Voice projection	5.00 (5)	4.67 (4-5)	-.33
Speaking rate	4.30 (3-5)	4.33 (3-5)	0
Eye contact	5.00 (5)	4.33 (3-5)	-.67
Speech Fluency	3.33 (2-5)	4.33 (4-5)	+1
Nervous appearance	2.30 (1-4)	2.67 (1-4)	+.34
Use of movement	4.00 (3-5)	3.67 (2-5)	-.33
Out of breath appearance	2.33 (1-4)	2.00 (1-3)	-.33
Use of gestures	4.33 (3-5)	4.00 (2-5)	-.33
Use of fillers	3.00 (1-4)	2.00 (2)	-1
Confidence	3.67 (2-5)	3.67 (2-5)	0
Overall ability	3.67 (3-5)	4.00 (3-5)	+.33

Note. BL = baseline; AT = awareness training; Δ = change in score.

Table 2

Public Speaking Anxiety Scale			
Item	BL	Post-AT	Δ
1. Giving a speech is terrifying	2.67 (2-3)	2.33 (2-3)	-.33
2. I am afraid that I will be at a loss for words while speaking	3.67 (3-5)	3.33 (2-5)	-.33
3. I am nervous that I will embarrass myself in front of the audience	4 (2-5)	2.67 (1-5)	-1.33
4. If I make a mistake in my speech, I am unable to re-focus	2.67 (2-3)	3 (2-5)	+.33
5. I am worried that my audience will think I am a bad speaker	4 (2-5)	1.67 (1-2)	-2.33
6. I am focused on what I am saying during my speech*	4.67 (4-5)	4 (2-5)	-.33
7. I am confident when I give a speech*	2 (1-3)	2.33(1-3)	+.33
8. I feel satisfied after giving a speech*	2 (1-3)	3(1-4)	+1
9. My hands shake when I give a speech	2.33 (1-3)	1.33 (1-2)	-1
10. I feel sick before speaking in front of a group	2.67 (1-5)	2 (1-4)	-.33
11. I feel tense before giving a speech	4 (3-5)	3 (2-4)	-1
12. I fidget before speaking	3.67 (2-4)	3.67 (3-4)	0
13. My heart pounds when I give a speech	3.67 (2-4)	3 (2-4)	-.33
14. I sweat during my speech	3 (1-4)	2.67 (2-3)	-.33
15. My voice trembles when I give a speech	2 (1-3)	2 (1-3)	0
16. I feel relaxed while giving a speech*	1	1.67(1-2)	+.33
17. I do not have problems making eye contact with my audience*	1.67 (1-3)	3	+2.33
Overall scale (once starred items had been reverse coded)	52.01	41	-11.01

Note. 1 = not at all, 2 = slightly, 3 = moderately, 4 = very, 5 = extremely. * Reverse-coded

Table 3

Treatment Acceptability			
	Isabella	Tatiana	Katherine
Acceptability of habit reversal procedures	-	5	5
Willingness to participate	-	5	5
Possible disadvantages of habit reversal procedures	-	5	4
Difficulty participating with habit reversal procedures	-	5	4
Likability of habit reversal procedures	-	4	4
Effectiveness of habit reversal procedures	-	4	4

Figure 1

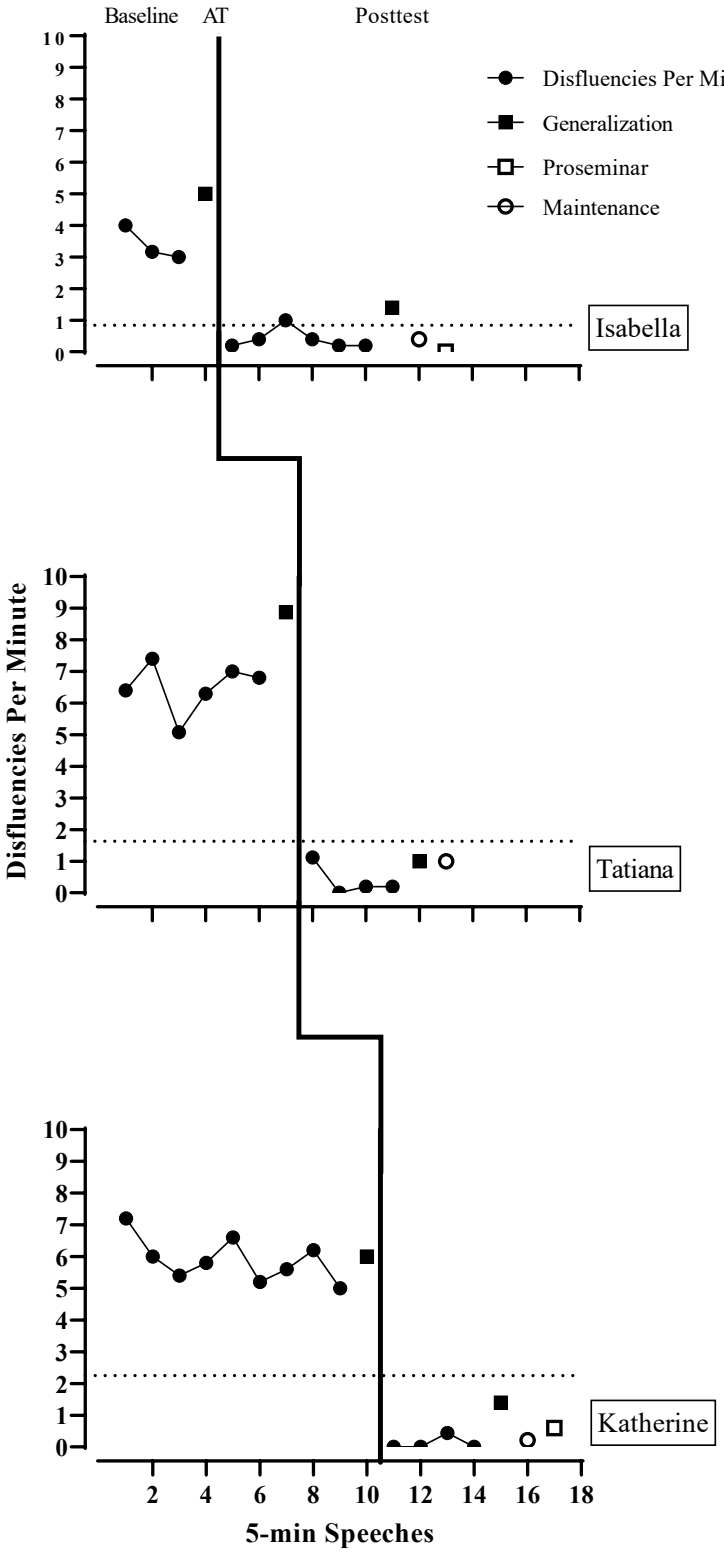
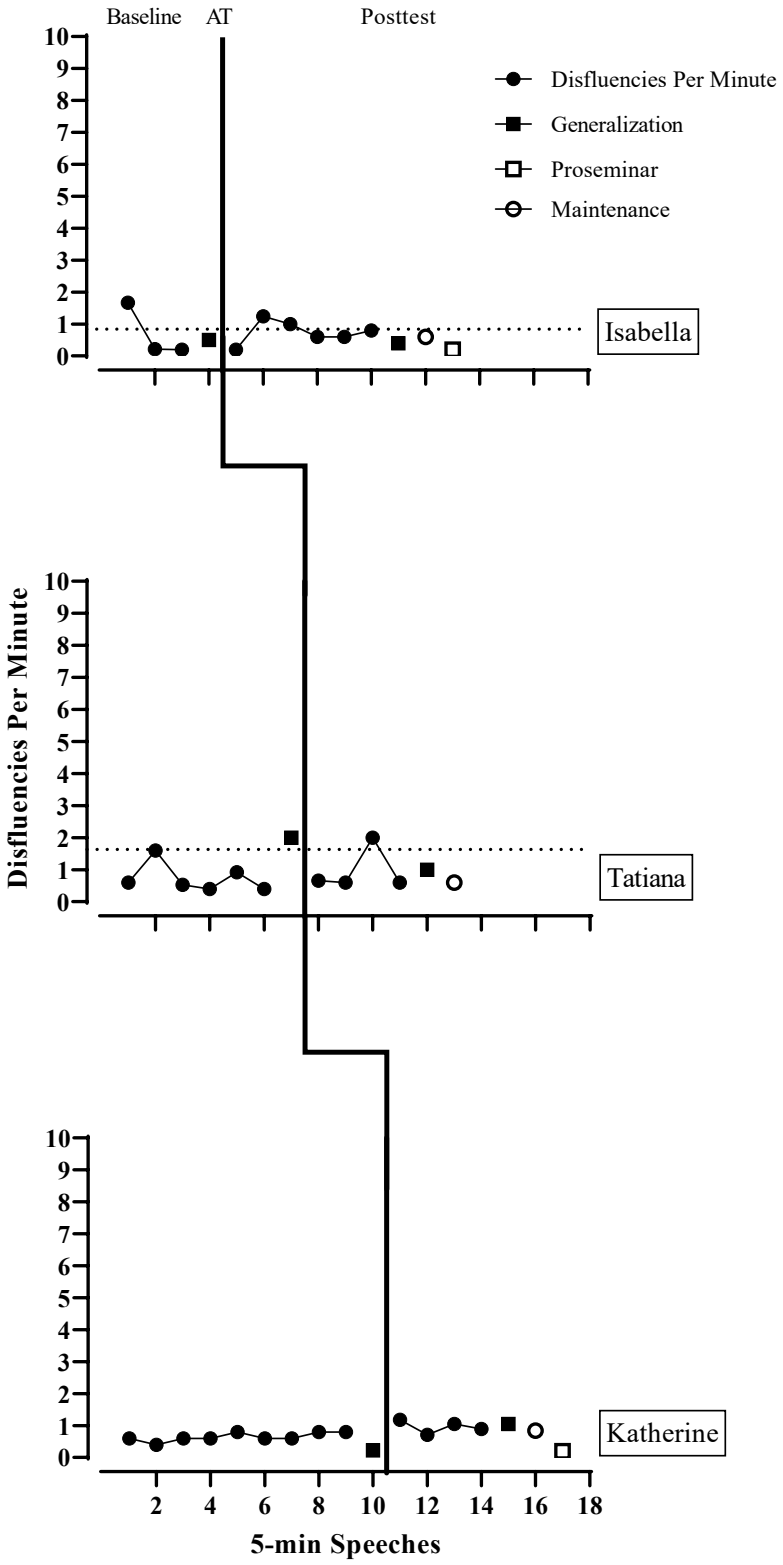

Baseline
AT
Posttest
Disfluencies Per Minute
Generalization
Proseminar
Maintenance
Isabella
Tatiana
Katherine
Disfluencies Per Minute
5-min Speeches

Figure 2


Baseline
AT
Posttest
Disfluencies Per Minute
Generalization
Proseminar
Maintenance
Isabella
Tatiana
Katherine
Disfluencies Per Minute
5-min Speeches

Appendix A: Speech Topics

1. My first job
2. If I could have any job I wanted…
3. My graduate school experience…
4. If I were an animal
5. The most memorable moment in my life…
6. If I could speak any language…
7. First relationship
8. If I could be born in any decade…
9. My favorite country
10. My favorite movie
11. If I could be anyone…
12. My dream place to live
13. My favorite season or time of year
14. If my life were a musical…
15. Ghosts I would like to meet
16. Favorite movie
17. My favorite band or musician
18. What I did on vacation
19. If I won the lottery…
20. What my life would be like if I had superpowers
21. My hometown
22. If I could only have one food for the rest of my life…
23. A time when everything went wrong
24. Favorite holiday
25. A hobby or pastime

Appendix B: Participant's Self-Rating Public Speaking Abilities and Confidence

Participant: _____ Session Number: _____

Please score each item by circling the number that best indicates how you feel about public speaking.

1. How comfortable are you when engaging in public speaking?

1	**2**	**3**	**4**	**5**
Not Comfortable		Somewhat Comfortable		Very Comfortable

2. How would you rate your overall ability as a public speaker?

1	**2**	**3**	**4**	**5**
Poor		Average		Excellent

3. How confident do you feel when engaging in public speaking activities?

1	**2**	**3**	**4**	**5**
Not confident at all		Somewhat Confident		Very Confident

4. How often do you use fillers, such as um, ah or er, during public speaking?

1	**2**	**3**	**4**	**5**
Very often		Sometimes		Not at all

5. While public speaking, how anxious are you?

1	**2**	**3**	**4**	**5**
Very Anxious		Somewhat anxious		Not anxious at all

Appendix C: Social Validity Survey - Awareness Training

Participant: _____

Please score each item by circling the number that best indicates how you feel about the habit reversal intervention.

1. How acceptable was the habit reversal intervention?

1	**2**	**3**	**4**	**5**
Not at all acceptable		Somewhat acceptable		Very Acceptable

2. How willing were you to participate in the intervention?

1	**2**	**3**	**4**	**5**
Not at all willing		Somewhat willing		Very willing

3. To what extent do you think there might have been disadvantages in the intervention?

1	**2**	**3**	**4**	**5**
Many likely		Somewhat likely		None likely

4. How difficult was it to participate in the habit reversal procedures?

1	**2**	**3**	**4**	**5**
Very difficult		Somewhat difficult		Not difficult

5. How much did you like the habit reversal intervention?

1	**2**	**3**	**4**	**5**
Not at all		Neutral		Very much

6. How effective was the intervention in terms of reducing your use of fillers or nervous mannerisms?

1	**2**	**3**	**4**	**5**
Not effective		Somewhat effective		Very effective

Appendix D: Public Speaking Ability Rating Scale (External Rater)

Participant: _____ Session Number: _____

Please score each item by circling the number that best indicates how you feel about the speaker's public speaking ability based on the speech you just viewed.

1. The speaker appeared comfortable.

1	**2**	**3**	**4**	**5**
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

2. The speaker's voice projection was acceptable.

1	**2**	**3**	**4**	**5**
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

3. The speaker spoke at an appropriate rate.

1	**2**	**3**	**4**	**5**
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

4. The speaker made eye contact with the audience.

1	**2**	**3**	**4**	**5**
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

5. The speaker's speech was fluent.

1	**2**	**3**	**4**	**5**
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

6. The speaker appeared nervous.

1	**2**	**3**	**4**	**5**
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

7. The speaker's use of movements was appropriate.

1	**2**	**3**	**4**	**5**
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

8. The speaker sounded out of breath.

1	**2**	**3**	**4**	**5**
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

9. The speaker's use of gestures was appropriate.

1	**2**	**3**	**4**	**5**
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

10. The speaker used fillers, such as um, ah, or er.

1	**2**	**3**	**4**	**5**
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

11. The speaker appeared confident.

1	**2**	**3**	**4**	**5**
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

12. How would you rate the speaker's overall public speaking ability?

1	**2**	**3**	**4**	**5**
Poor		Average		Excellent

Appendix E: Public Speaking Anxiety Scale

1. Giving a speech is terrifying _____

2. I am afraid that I will be at a loss for words while speaking _____

3. I am nervous that I will embarrass myself in front of the audience _____

4. If I make a mistake in my speech, I am unable to re-focus _____

5. I am worried that my audience will think I am a bad speaker _____

6. I am focused on what I am saying during my speech* _____

7. I am confident when I give a speech* _____

8. I feel satisfied after giving a speech* _____

9. My hands shake when I give a speech _____

10. I feel sick before speaking in front of a group _____

11. I feel tense before giving a speech _____

12. I fidget before speaking _____

13. My heart pounds when I give a speech _____

14. I sweat during my speech _____

15. My voice trembles when I give a speech _____

16. I feel relaxed while giving a speech* _____

17. I do not have problems making eye contact with my audience* _____

Note. 1 = not at all, 2 = slightly, 3 = moderately, 4 = very, 5 = extremely.

* Reverse-coded.

Appendix F: Treatment Fidelity Checklist - Baseline and Assessment

Participant: _____ Session Number: _____

1. Was the participant given a choice between two topics?

Yes No

2. Was the participant given 5 min to prepare the speech?

Yes No

3. Were materials and resources provided?

Yes No

4. If the participant stopped speaking for more than 15 s or attempted to end their speech before 3 min had elapsed, did the PI use the prompt, “Please continue?”

Yes No

5. Was the speech at least 3 min in length?

Yes No

Appendix G: Treatment Fidelity Checklist - Awareness Training-Video

Awareness Training (Video) Checklist

Participant: _____

1. Did the participant and PI discuss the topography of the target behavior?

Yes No

2. Did the participant practice identifying the target behaviors in a video clip before giving a speech?

Yes No

3. Did the PI raise their hand after 1-second each time the participant engaged in the target behavior?

Yes No

4. Did the participant identify 100% of occurrences of the target behavior in one speech or 85% in two consecutive speeches before awareness training ended?

Yes No

Appendix H: Treatment Fidelity Checklist- Awareness Training-In Vivo

Awareness Training (In Vivo) Checklist

Participant: _____

1.Was the participant given a choice between two topics?

Yes No

2. Was the participant given 5 min to prepare the speech?

Yes No

3. Were materials (writing utensils and paper) and resources (textbook) provided?

Yes No

4. Did the PI raise their hand 1-second after each time the participant engaged in the target behavior?

Yes No

5. Did the PI raise the white 8 ½ by 11-inch piece of paper after 4 min had elapsed?

Yes No

6. Did the PI raise the red 8 ½ by 11-inch piece of paper after 5 min had elapsed?

Yes No

7. If the participant stopped speaking for more than 15 s or attempted to end his or her speech before 3 min had elapsed did the PI use the prompt, “Please continue?”

Yes No

8. Was each speech at least 3 min in length?

Yes No