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WIP: Reducing public communication apprehension through a targeted intervention

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Introduction

Public communication such as speaking in meetings, group discussions, and public presentations is a common aspect of professional life, including for engineers: ABET includes "an ability to communicate effectively with a range of audiences" as one of the essential criteria of accreditation[1]. Yet many engineering students experience communication apprehension, mirroring the general collegiate population [2], [3]. Fear of public communication is exacerbated by anxiety [4], [5], and students anxiety levels have increased by almost 50% from the baseline a decade ago [6]. While multiple studies have addressed fear of public speaking for engineers [3], [7], [8], most have been semester-long courses and few have used validated tools to measure changes in public speaking apprehension. There is a need for short but effective interventions to reduce public communication apprehension.

Utilizing the theoretical underpinning of Carol Dweck's growth mindset[9], [10], [11], [12], a singular active-learning lesson was developed and implemented to teach students how to overcome barriers to public speaking. It is well-established that students who embrace the growth mindset are more resilient to challenges, have less anxiety in general, and less communication apprehension in particular[13], [14], [15]. This work in progress shares the results of this targeted intervention on a biomedical engineering (BME) PhD-level literature review class.

Methods

Class: The class consisted of 42 BME PhD students taking a mandatory 2-credit pass/fail course that focuses on reading and presenting academic journal articles in preparation for a qualifying exam.

Intervention: An interactive 95-min lesson on impromptu speech was designed, rooted in Dweck's growth mindset theory and performance-based theory — that is, the theory that students' apprehension can be addressed through practicing awareness of one's expectations and beliefs around public communication. In this lesson, students first brainstormed barriers to successful impromptu public communication. These barriers were then grouped into five categories based on the "reason" for that difficulty: 1) Preparation, 2) Question ambiguity, 3) Executive function failure ('brain fog'), 4) Response ambiguity, 5) Inquirer bias. For example, a barrier of "lacking knowledge of the topic" went under the "Preparation" category. Students then simulated an "oral exam" on a simple BME concept (e.g. fundamentals of polymerase chain reaction) in groups of four, where each student took on a role (see Figure 1). This activity had several functions: it increased students' engagement with the content; it helped crystallize perceived barriers to public communication by allowing students to experience them in a safe environment; and it put growth-mindset principles into practice by highlighting skills rather than inherent ability as the goal of the exercise.

After this exercise, the students were taught specific techniques and practices to overcome each of the barrier categories, such as box breathing, active listening, and mental scaffolding for speeches (e.g. PREP, Point Reason Example Point)[16], [17], [18]. Beyond this singular lesson, students had an additional further opportunity to practice the content based on the existing class content, as students could use this content to prepare for their presentations of academic journal articles..

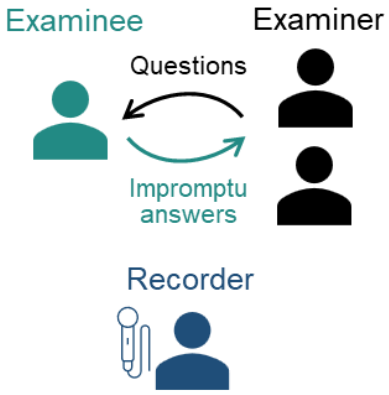

FIGURE 1: Student roles during exercise. Examinees were asked questions by two examiners, with a recorder observing and taking notes on the interaction. The recorder also interviewed the examinee afterwards on the barriers they experienced while trying to answer questions in real time.

Data collection and analysis: A modified version of the Personal Report of Communication Apprehension (PRCA-24) was given at the start and end of the semester to measure the impact of this intervention on students' communication apprehension [19], [20]. The PRCA is a validated instrument and the most common measure of anxiety related to communication, where a high score (max 90) indicates severe apprehension, and a low score (min 18) indicates confidence in public speaking. Additionally, a simple Likert-scale survey with an open-ended option was given at the end to gather reflections. Descriptive statistics, Shapiro-Wilk Test for normality, and paired t-test were performed. Additionally, pre- and post-intervention scores were analyzed with a mixed two-way repeated measures ANOVA (treating time as the within-subject factor) with follow up pairwise comparisons using Holm-Bonferroni correction. Following the American Statistical Society's (ASA) 2016 statement on p-values, an exclusively binary decision rule of significance was avoided: instead, following ASA's guidance, exact p-values, Cohen's d (or equivalent), and 95% confidence intervals were reported[21], [22]. However, language of significance was kept for figures and for convention during interpretation. This study has been reviewed and deemed exempt by the university's IRB, and students opted into taking the survey

Results and Discussion

40 of the 42 students completed surveys at both time points, and the score distributions passed the Shapiro-Wilk test for normality. The initial PRCA test yielded a distribution with three populations: students with high apprehension (PRCA>65, n = 14), students with moderate/normal apprehension (n = 18), and students with low apprehension (PRCA<41, n=8). Ensemble comparison of pre/post intervention scores yielded a small but statistically significant decrease in student apprehension (Cohen's d= 0.29, p = 0.036). When analyzed by subgroup via ANOVA, far more significant results are obtained (see Figure 2). The high-apprehension group saw a large drop (-8.8 points, CI [-3.9, -13.7], p = 0.0081) in apprehension, the normal/moderate group had no statistically-relevant change in their score (-2.7 points, CI [1.6, -7.0], p=0.26), while the low-apprehension group saw an increase in apprehension by 6.4 points (CI [-0.1,12.8], p=0.074), though that increase was only weakly significant. The Time × Group interaction (η^2p = 0.28, p = 0.0023) indicates that the change in PRCA scores from pre- to post-intervention differed significantly and substantially across the three baseline-apprehension groups. The partial eta-squared (η^2p), which measures the interaction effect size (η^2p = 0.28) is large by conventional standards, indicating that a substantial portion of the variability in change scores is associated

with differences in how the groups responded over time. Stated simply, the intervention had unequal effects across baseline-apprehension levels, producing the clearest benefit among those who entered the course with high public speaking apprehension. Overall, 60% of all students saw a measurable decrease in their apprehension as measured by the PRCA.

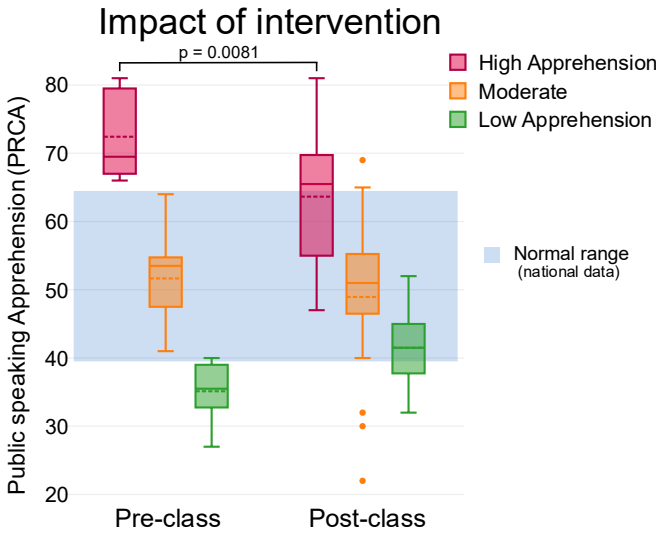

FIGURE 2: Boxplots of PRCA scores pre-class and post-class by apprehension grouping.

These results suggest that a single, targeted lesson on overcoming barriers to public communication led to decreases in apprehension by most students. In particular, students who entered the class being highly anxious about impromptu speech left the class more confident and less apprehensive: indeed, half of the high-apprehension group saw double-digit decreases in their PRCA score. Likert survey data confirmed the PRCA results overall, where 55% of students agreed or strongly agreed that they felt more confident in their impromptu speech ability, with only 10% disagreeing. Interestingly the low-apprehension group trended toward becoming more apprehensive. It is difficult to directly determine the cause of this, but it may be due to overconfidence. While students did not voluntarily share open-ended comments about being overconfident, the self-reported response of using the content of the lecture hints at overconfidence: 75% (6/8) of the low-apprehension group reported that they did not look at the lecture material ever again for the class, while only 34% of the rest of the class (11/32) reported not looking at the lecture content again.

In conclusion, this study demonstrates that even a singular interactive lecture devoted to teaching impromptu speech and public speaking can lead to measurable decreases in student apprehension and increases in confidence for those with high communication apprehension. This is an important result in an era where students increasingly struggle with anxiety[6].

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