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Voice Pitch Influences on Teaching Evaluations and Student Learning

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VOICE PITCH INFLUENCES ON TEACHING EVALUATIONS AND STUDENT LEARNING

being

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ABSTRACT

Prior research in the realm of marketing and voting behaviors have indicated how voice pitch can have an impact on consumers' and voters' perception of personality characteristics. With the rise of online lectures, this study examined the impact of voice pitch, gender of a professor, and the subject taught on professor evaluation and student learning. The study simulated an online lecture where participants listened to a prerecorded lesson of Generalized Anxiety Disorder or Standard Deviation. This study looked to see if different voice pitch (high pitch, low pitch) of opposing genders (male, female) would have an effect on a student's perception of the professor and comprehension of the material. By examining the results of a self-created professor evaluation and a self-created quiz based on the lecture, this study suggested voice pitch, gender of a professor, and subject taught have a significant effect on the student's evaluation of the professor. However, no significant interaction effect was found. In addition, the subject taught and the interaction between the subject and gender of a professor had a significant effect on the student's comprehension of the lecture. This study provides insight into the realm of online education identifying voice pitch, gender, and subject may have an effect on a student's evaluation of a professor and comprehension of the material.

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TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

INTRODUCTION

Professor Evaluations

In the realm of higher education, professors strive to teach the new generation the knowledge in their fields. Though course content and even delivery method continuously develop, one aspect of education remains constant: the importance of student learning. Traditionally, teaching evaluations have been used to subjectively measure students' perception of learning and their satisfaction. Teaching evaluations can also be used to assess professors' teaching effectiveness, which can be used in the promotion or tenure processes. The vast majority of professors want to help their students learn at their maximum potential; therefore, professors take many of the comments into consideration and make changes when necessary. However, does a student's rating of a professor on the teaching evaluation always pertain to the professor's style of teaching, presentation or knowledgeability? Or perhaps a student's formulated opinions of the professor are influenced by the student's first impression of the professor, strengthened by the extraneous variables that make each professor unique and then further developed as the semester progresses.

Centra and Gaubatz (2005) have extracted several leading variables in the evaluation of a professor in their study: 1) overall learning, 2) effort and involvement of students (responsibility/academic gains), and 3) value of class assignments, exams, and grading. Additionally, communication skill (instructor clarity, example usage, challenging questions and problems, and enthusiasm) was another variable to be considered outside of assignments/exams/grades. Along with communication and clarity

of subject material, prior research has indicated that positive professors are able to hold a humanistic view (a perspective focusing on empathy and good in others) of their students. Thus, positive professors were more likely to further develop their communication skills to improve their interactions with students (Ginsberg, 2007).

By using a more humanistic pedagogical approach, professors can engage their students in the learning process by both teaching in the 'here and now' and concerning themselves with the comfort of their students by using a more research-based instruction approach rather than a traditional lecture approach (Deslauriers, Schelew, & Wieman, 2011). This study, in turn, ties into prior research, which shows that a simple lecture of the material is not the most productive application in teaching; rather, for high quality teaching methods, communication style and organization of the material must be considered (Dee, 2007).

As shown in previous studies, student learning, types of assignments, grades, and communication with the instructor still play a key role in professor evaluations; however, extraneous variables have also influenced such evaluations. In the current paper, I propose that voice pitch may contribute to a student's perception of a professor, thereby affecting the professor's evaluation. Additionally, I propose that the voice pitch of the professor may also have an effect on a student's learning. Prior to discussing the role of voice pitch in teaching evaluations, a brief overview of extraneous variables related to evaluation will be necessary.

Factors Indirectly Affecting Professor Evaluations

Past literature states that certain personality characteristics play a role in the evaluation process (Arbuckle & Williams, 2003; Bachen, McLoughlin, & Garcia, 1999; Basow, 2000; Ginsberg, 2007). Personality characteristics of male professors have been examined to identify what qualities are perceived in a good and poor professor (Basow, 2000). Those professors who are rated "best" tend to exhibit personality traits that are neither solely masculine nor solely feminine, but rather a balance between the two. In comparing "best" professors to "worst" professors, "best" professors were perceived to be caring, interesting, helpful, knowledgeable, and fair. In contrast, "worst" professors were described as being unclear and disorganized. These characteristics may hinder a student's perception of learning and, therefore, may influence the student's ratings on professor evaluations.

In addition, more subjective or personal preference factors such as physical attractiveness play a role in the professor evaluation. Professors who are viewed as physically attractive generally receive higher student evaluations than professors who are considered less attractive (Riniolo, Johnson, Sherman, & Misso, 2006; Romano & Bordieri, 1989). Though physical attractiveness may seem irrelevant to teaching, it still affects the professor evaluations. On one hand, these prior findings could lead one to question the validity of teaching evaluations. On the other hand, the attractiveness of a professor may be a reflection of the professor's productivity-- that is to say, teaching productivity in the classroom may be enhanced by a professor's attractiveness (Hamermesh & Parker, 2005). Furthermore, attractive professors may be perceived as

more organized, friendly, caring, and helpful, all of which help improve ratings on evaluations. In some cases, the attractive professors are also perceived as being more likely to be recommended to other students, and when a student gets a failing grade, the attractive professors are not as heavily blamed as unattractive professors (Romano & Bordieri, 1989). If physical attractiveness can be inferred by a person's voice, then voice is expected to affect teaching evaluation as well.

Age can be another factor indirectly affecting teaching evaluations. The previous research does not always indicate significant effects on the relationship between age and educational effectiveness, though many students presume their "best" professors to be mainly in their 30s or 40s (Basow, 2000). Additionally, young male professors had higher ratings than older males, younger females, and older females. Furthermore, young males were rated more enthusiastic and using a more meaningful voice tone than the other conditions (Arbuckle & Williams, 2003). Though there is limited research on the direct effects of age in education, there are numerous studies that discuss age and the stereotypes associated with it, which can be further applied to education. For example, the younger a voice sounds, the healthier the speaker is believed to be (Vaught, 2012), while older speakers are stereotypically perceived to be less powerful and less engaging than younger speakers (Montepare, Kempler, & McLaughlin-Volpe, 2014). The age of the professor may play a role in a student's perception of teaching effectiveness because of the relationship of the student to the professor. Students may associate themselves more easily with a professor when the age gap is small. Students may perceive that a

professor closer to their age would be able to understand more easily the hardships and joys of the collegiate atmosphere.

Prior research in professor evaluations has extensively examined the traditional classroom professors and how subjective factors such as attractiveness, age, and demeanor may contribute to students' evaluations of the professor. With fast increases in online education and its popularity in the current society, students are exposed to various kinds of voices through voice threads, voice recordings, and PowerPoint presentations. In these environments, a professor's voice may start to play a more crucial role than the physical appearance of a professor or face-to-face communication with him/ her. This new aspect of teaching will be explored in the current study.

Pitch and Gender

A person's voice is unique, and people can often infer a lot of information by hearing a voice. A past study has found that various personality traits, as well as emotional state, can be inferred from a voice (Krauss, Freyberg, & Morsella, 2002). This study can be applied to a classroom setting. Think about the following situation. Awaiting the start of a new class, a student observes the new professor. A young, professional looking instructor with a warm smile makes the student excited for the class, until the lecture starts and the student realizes the professor speaks with an annoying, monotonous voice. The discrepancy between expectation based on the appearance and auditory experience might unfortunately increase the student's dissatisfaction. A common element that many professors possess is the art of communication, particularly vocal communication.

Voice production is a complex system. In its most simplified form, air pressure is released from the lungs and is energized by body muscles before passing between the vocal folds, which vibrate and send the vibratory energy out as sound waves or frequencies that the students hear and perceive as pitch (Nair, 2007). Men and women tend to have different averages in voice pitch, as it has been observed throughout time. On average, male voices tend to have lower-pitch (M = 120 Hz) than female voices (M = 210 Hz) (Pépiot, 2014; Traunmüller & Eriksson, 1994). Research has also identified that voice pitch decreases with age; that is to say, as a group, older male and female speakers tend to have lower-pitched voices on average (M = 159 Hz) than young and middle-aged individuals (M = 204.85 Hz) (Xue & Deliyski, 2001).

Further research into perception has identified voice pitch to be an indirect participant in dating preferences, advertisements, political voting behaviors, large corporate leadership positions, and even perceptions of personality. In regard to attraction, evolutionary psychologists have found that men tend to have a stronger preference toward females with high-pitched voices (Feinberg, DeBruine, Jones, & Perrett, 2008; Liu & Xu, 2011), and females tend to have a stronger preference towards males with low-pitched voices (Collins, 2000; Jones, Feinberg, DeBruine, Little, & Vukovic, 2010; Re, O'Connor, Bennett, & Feinberg, 2012). In the classroom setting, male students, if they had to have a female professor, may unconsciously prefer that a higher-pitched female teach the class rather than a lower-pitched female. Likewise, female students, if they had to have a male professor, may unconsciously prefer that a lower-pitched male taught the class rather than a higher-pitched male.

Advertising firms in the marketing world use voice effects to draw their consumers into purchasing their product. By fluctuating the voice or altering the pitch, the marketing team can make commercials or infomercials that will increase sales. It was observed that low-pitched voices resulted in more sales because consumers perceived these voices as more credible and persuasive in informative-descriptive messages compared to high-pitched voices (Martin-Santana, Muela-Molina, Reinares-Lara, & Rodriguez-Guerra, 2015). A low male voice is not only perceived to be more credible and persuasive, but also is typically used with targeting female audience members because female listeners are more likely to purchase products when a man with a lower-pitched voice advertises the item. Conversely, when targeting males in an advertisement, the voice quality does not have much of an effect (Wiener & Chartrand, 2014). A similar effect may be seen in the educational setting. With the belief that lower-pitched voices are more knowledgeable and credible than higher-pitched voices, students may characterize low-pitched voices as more credible and persuasive, and in turn pay closer attention to the low-pitched professors.

In the realm of political voting behaviors and leadership roles in large corporate entities, many studies agree that people tend to vote more for men or women who have a lower-pitched voice (Klofstad, 2015; Klofstad, Anderson, & Peters, 2012; Tigue, Borak, O'Connor, Schandl, & Feinberg, 2012). In fact, participants preferred to vote for a candidate with a lower-pitched voice when they had to choose between two unfamiliar male voices speaking a neutral sentence. The dominance of the lower-pitched male voices is then relevant not only in voting behaviors, but also in management of corporate

enterprises. In fact, when looking at CEOs of companies, larger corporate enterprises tend to be headed by CEOs who have a deeper voice (Mayew, Parsons, & Venkatachalam, 2013). Additionally, men who want to be perceived as having physical dominance lower their voice pitch when approaching a competitor (Puts, Gaulin, & Verdolini, 2006). This correlation may be due to the characteristics associated with voice pitch.

Prior research has indicated personality characteristics of men with lower-pitched voices as being more pleasant, persuasive, masculine, assertive, authoritative, confident, convincing, intelligent, reliable, trustworthy, truthful, (Dey, Freinberg, & Kim, 2009) attractive (Collins, 2000), and dominant (Dey, Freinberg, & Kim, 2009; Jones, Feinberg, DeBruine, Little, & Vukovic, 2010; Puts, Gaulin, & Verdolini, 2006; Puts, Hodges, Cardenas, & Gaulin, 2007). Likewise, men with high-pitched voices were viewed as less confident, less truthful, nervous, weaker, and less emphatic (Apple, Streeter, & Krauss, 1979; Dey, Feinberg, & Kim, 2009). The research behind voice pitch and women is not as extensive as men; however, women, with a lower-pitched voice were more successful at obtaining leadership positions than women with a higher vocal pitch (Klofstad, Anderson, & Peters, 2012). Part of this preference may be due to females having more of a breathy voice compared to men (Klatt & Klatt, 1990).

If voice pitch has an impact in all of these areas, could it be possible that voice pitch also plays a role in a student's perception of a professor and, consequently, reflects this impression on the professor evaluations? Likewise, is it possible that voice pitch has an effect on student learning? While there may not be numerous studies that explore this

possibility, the few that exist encourage further investigation into the effects of voice pitch.

The Role of Pitch in the Education Setting

In a study done by Samoza, Sugay, Arellano, and Custodio (2015), 120 college students listened to one of four different voice types (high-pitch female, low-pitch female, high-pitch male, low-pitch male) reading 50 random duo-syllabic words. To test memory recollection, participants were asked to write as many of the words they could recall from the recording. The study found that listeners of the high-pitched male voice had the highest mean score ($M = 12.5$) of words recalled and low-pitched male voice had the lowest mean score ($M = 8.48$). Additionally, it was found that both of the high-pitched voices had higher mean scores than the low-pitched voices in both of the genders. From this study, it was concluded that voice pitch might aid in a student's memory retention and learning capacity. If voice pitch is affecting student memory retention rates of random duo-syllabic words, can this effect carry over into the classroom environment where students learn more conceptual content?

In a series of experiments by Helfrich and Weidenbecher (2011), a multitude of participants were exposed to one of six voices (Pitch: High, Normal, Low x Gender: Male, Female). Very low-pitched and very high-pitched voices resulted in higher memory retention rates than their normal voice pitch counterparts. The Helfrich and Weidenbecher (2011) study depicted low-pitched voices more positively rated than high-pitched voices. These results were explained in part by the argument of emotional

associations; individuals with lower-pitched voices had higher ratings of agreeableness, whereas high-pitched voices were associated with higher levels of disagreeableness.

Previous studies have contrary results in regard to gender when not accounting for the voice. A few studies found no differences on professor evaluations when looking at the gender of student to the gender of professor interaction (Helfrich & Weidenbecher, 2011; Somoza, Sugay, Arellano, & Custodio, 2015). However, other studies indicate a high level of bias towards male instructors over female instructors (MacNell, Driscoll, & Hunt, 2014). In contrast, much of the previous research demonstrates results supporting female professors as being rated more favorably than their male peers (Romano & Bordieri, 1989), specifically when female students are rating female professors (Bachen, McLoughlin, & Garcia, 1999; Basow, 2000; Centra & Gaubatz, 2000). Female students demonstrating a preference towards female professors could be a bias all students face when they evaluate their professors. When relating professor gender to pedagogical characteristics and course content characteristics, gender biases occur with male students favoring male faculty and female students favoring female faculty (Young, Rush, & Shaw, 2009). Fortunately, faculty gender does not necessarily play a role when students identified their perceptual ratings of "worst" professors (Basow, 2000).

What has yet to be looked at is how voice pitch can affect a student's learning outcome in a video recorded lecture over conceptual educational content, as well as if it affects the evaluation of a professor. Prior research has explored many objective and subjective components of the evaluations. Therefore, the current study aims to explore whether voice pitch can influence a student's learning comprehension and teaching

evaluation. The study will also explore if differing voice pitches affect an evaluation in differing subject areas, such as quantitative coursework (majority of STEM subjects) and non-quantitative coursework (humanity classes).

The Role of Different Subject-Matter in Teaching Evaluation

Based upon prior findings of quantitative and non-quantitative courses, if a student was required to take either a music appreciation course or an introductory physics course, it can be predicted the majority of individuals would choose to take a music appreciation class. This decision may be based on the student's interest, but it may also be based on the subject matter as it is comparing quantitative (introductory physics) to non-quantitative courses (music appreciation). Prior research has indicated that a student's interest in taking courses such as statistics is nearly six standard deviations below a student's interest in taking a non-quantitative course (Uttl, White, & Morin, 2013). Drawing from the example above, a professor in higher education may experience differing evaluations from the music appreciation class and the introductory physics class because of the interests or desires of the students. Prior research has indicated that if a student's interest in the course increases as the course progresses, the overall teacher evaluation will also increase (Spooren, Brockx, & Mortelmans, 2013). Likewise, if a student has a higher desire to take the course, the overall teacher evaluation will reflect higher scores than the student who has less of a desire to take the course (Griffin, 2004).

A student's perception of the science, technology, engineering, and mathematics (STEM) courses is that they are far more difficult in comparison to other non-science courses (Coe, Searle, Barmby, Jones, & Higgins, 2008). The natural science courses, also

referred to as the hard sciences, tend to be rated among the most difficult classes (Centra, 2003; Kember & Leung, 2010; Uttl & Smibert, 2017; Uttle, White, & Morin, 2013), and they are typically the classes with lower average grades and ratings (Centra, 2003; Uttl & Smibert, 2017).

Uttl and Smibert (2017) conducted a study looking at student evaluations of teaching across four disciplines: English, history, psychology, and math. The results indicated that math classes received lower average rankings than the other three disciplines, both independently and combined. Similarly, Centra (2009) examined courses in the natural sciences, mathematics, engineering, and computer sciences and then compared them to courses in the humanities (English, history, and language). This study identified that the average overall evaluation of instruction was 3.87/5 for classes in natural sciences, mathematics, engineering, and computer science. The same study also indicated an average overall evaluation of instruction was 4.04/5 for courses in the humanities.

There may be several explanations for the results of these and other related studies. STEM courses may be viewed as having a higher level of student preparation and effort, having a higher overall perception of being more difficult, having lower faculty/student interaction, having higher difficulty in the communication of material, or having lower interest in material (Centra, 2009; Centra & Gaubatz, 2005). There is little support that easy grading or low workloads translate into higher professor or subject evaluations. However, there is support that teaching a challenging class (such as math, biology, chemistry, or physics) starts a domino effect by requiring a student to exhibit

more effort and preparation, which may then result in a lower overall evaluation of the professor (Thornton, Adams, & Sepehri, 2010).

The difference between the STEM or quantitative courses and the humanities or non-quantitative courses may lie in the importance of developing the student discussion. Unlike physics or mathematics where the content is concrete and does not so easily stray from the formula, social sciences, like psychology, discuss various philosophies and differences (Centra & Gaubatz, 2005). By addressing more of the thoughts and differences in the social sciences, the students discuss more with the professor, consequently building rapport and possibly giving the professor a more positive evaluation. This further discussion may also lead to students development of knowledge, whereas physics and mathematics have little room for discussion due to the more concrete methods. Thus, little rapport is likely to be built between the students and the professor (Neumann & Neumann, 1985).

Though in-class discussion may be important for student learning, could the gender of a professor in STEM classes contribute to student learning? There have been a multitude of studies that explored the relationship of gender and subject matter on professor evaluations, particularly in the STEM faculty. The female to male gender difference in STEM faculty is roughly two to three respectively (Hurtado & Figueroa, 2013). This gender difference has an increasing effect on female students' performances in the math and science classes. Many female students who take courses from male professors in the natural and social sciences indicate a lower likelihood of taking future math and science classes. However, if taken with female faculty, this trend is not as

evident (Carrell, Page, & West, 2010). Perhaps voice pitch can help explain this case. Higher voice pitch, as in a female voice, has characteristics of being more caring and sounding more excited than a male voice (Trouvain, Schmidt, Schroder, Schmitz, & Barry, 2006).

With the majority of natural science courses taught by men, students might be accustomed to hearing a relatively low-pitched voices, which may be students' expectations. This expectation may also impact the student's evaluations of the professor by suggesting voice pitch influences the students in alternative classes. Higher-pitched voices have produced higher mean scores in learning than low-pitched voices in both of the genders in the Samoza, Sugay, Arellano, and Custodio (2015) study. Perhaps then, one of the contributing factors in professor evaluations is due to the higher number of men (lower-pitched voices) in the STEM classes in comparison to the humanities classes.

Based on the past findings, the current study aims to investigate the role of voice pitch in teaching evaluations and student learning. Specifically, this study intends to examine the influence of pitch, professor gender, and subject matter on professor evaluations, teaching effectiveness and overall student learning. A pilot study was conducted to determine if voice pitch can be differentiated by the population of participants and to determine further teacher evaluation questions.

Pilot Study

Pilot data have been gathered to assess the impact of pitch in teaching evaluation. This pilot study followed a 2(gender: male, female) x 2(voice pitch: low, high) between-subjects experimental design with voice evaluation and professor evaluation.

Participants

There were 143 participants, Male: 50, Female: 92, other: 1: (M = 19.63, SD = 1.70), recruited from general psychology classes. They were mostly Caucasian (77.6%), followed by Hispanic (7.7%), and African American (5.6%). The majority of the students were first years (53.8%), followed by second years (26.6%), third years (11.9%), and four plus years (7.7%). All data was collected following APA ethical guidelines.

Materials

To mimic an online class, a lecture audio (topic: General Anxiety Disorder) was embedded into the PowerPoint slides. The lecture notes on each PowerPoint slide was typed with black ink in Calibri font on a white background to control for any personal preferences towards design of slides.

Voice pitch (high and low) was self-manipulated by the recorded individual. Both male and female individuals were senior theatre majors who were enrolled at a separate university from the one where the study was conducted. Female low-pitch was manipulated electronically due to the lack of auditory difference between the self-manipulated high and low-pitch. The voice recordings were recorded using the app "Voice Memos" on an IPhone 5 and converted into an mp4 video file using IMovie. To further control familiarity bias, the recordings were of one female and male student from a separate university. Each read from the same script (Appendix A) for generalized anxiety disorder. To help control for voice differences, the same male and female were used to record both the high-pitch recording and the low-pitch recording used to make the presentation.

This study used a self-created voice evaluation and self-created professor evaluation forms. The voice evaluation is an eleven-question evaluation that asks participants to rate each question on a seven-point Likert scale ranging from 1 (Strongly Disagree) to 7 (Strongly Agree). For example, “The presenter had a high-pitched voice” and “The presenter had a caring tone”. The professor evaluation is an eighteen-question evaluation divided into three different categories each with six questions: professionalism of the instructor, future interaction with the instructor, and perception of learning. Participants were asked to rate each question on a seven point Likert scale ranging from 1 (Strongly Disagree) to 7 (Strongly Agree). For example, professionalism of professor: “I feel the presenter was informative”, future interaction with professor: “I would like to listen to another lecture from this professor”, and perception of learning: “I feel I learned more about this topic”.

Results

Manipulation check showed a significant difference between low-pitch (M = 6.20, SD= 2.82) and high-pitch (M = 11.90, SD = 2.14) conditions, $F(1, 141) = 183.06$, $p < .05$, $\eta^2 = .56$. A manipulation check also showed a significant difference between masculinity (M = 6.59, SD = 3.27) and femininity (M = 10.02, SD = 3.65) between male and female voices, $F(1, 141) = 35.01$, $p < .05$, $\eta^2 = .20$.

Cronbach’s alpha was conducted to determine reliability of the three categories of the professor evaluation: The professionalism of professor consisted of 6 items ($\alpha = .86$), the future interaction of professor consisted of 6 items ($\alpha = .90$), and the perceived learning consisted of 6 items ($\alpha = .83$).

A 2 (gender: male, female) x 2 (pitch: high, low) MANOVA was performed on voice pitch evaluations using seven characteristics: (caring, pleasant, persuasive, approachable, attractive, authoritative, and trustworthy). A significant effect was found $\lambda(7, 135) = .71$, $p < .001$. Follow-up Univariate Analysis of Variance (ANOVA) indicated that voice characteristic "caring" was significantly different between high-pitch ($N = 69$) and low-pitch ($N = 74$), $F(1, 141) = 13.01$, $p < .001$). Authoritative tone had also shown a significant difference between voice pitch (high, low), $F(1, 141) = 65.13$, $p < .001$). No other significance was found between high-pitch and low-pitch for other voice characteristics.

An ANOVA was run to look at the effect of voice pitch and gender on the professionalism of professor. The results of the ANOVA did not show a significant main effect between male ($M = 32.69$, $SD = .66$) and female ($M = 31.60$, $SD = .74$), $F(1, 139) = 1.21$, $p = .27$, $\eta^2 = .009$, nor between high-pitch ($M = 31.76$, $SD = .70$) and low-pitch ($M = 32.52$, $SD = .70$), $F(1, 139) = .60$, $p = .44$, $\eta^2 = .004$.

An ANOVA examined the effect of voice pitch and gender on the future interaction with professor. The results of the ANOVA did show a significant main effect between male ($M = 29.39$, $SD = .82$) and female ($M = 26.60$, $SD = .92$), $F(1, 139) = 5.16$, $p = .025$, $\eta^2 = .036$. However, no difference was found between high-pitch ($M = 28.07$, $SD = .87$) and low-pitch ($M = 27.93$, $SD = .86$), $F(1, 139) = .01$, $p = .91$, $\eta^2 = .00$, nor a significant interaction effect, $F(1, 139) = .04$, $p = .85$.

Lastly, the results of the ANOVA did not show a significant main effect for perception of learning between male ($M = 29.63$, $SD = .74$) and female ($M = 27.77$, SD

= .83), $F(1, 139) = 2.81$, $p = .10$, $\eta^2 = .02$, nor a significant main effect between high-pitch ($M = 28.58$, $SD = .79$) and low-pitch ($M = 28.81$, $SD = .78$), $F(1, 139) = .04$, $p = .84$, $\eta^2 = .00$. Finally, the results had a marginal significant interaction effect between gender and pitch, $F(1, 139) = 4.07$, $p = .05$, $\eta^2 = .03$.

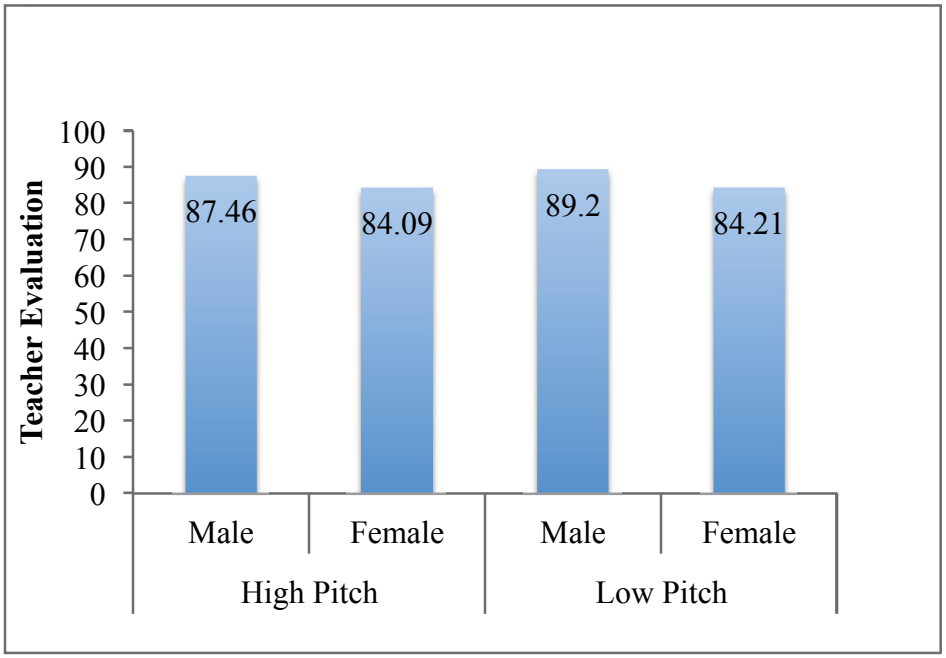

Figure 1. Average Overall Evaluation Scores of Professors.

Discussion

The results showed no statistically significant difference among overall teaching evaluation even though the differences between four combinations of voice pitch were perceived. However, in support of past studies, a male voice was preferred over a female voice and the gap widened as the female pitch was raised. If students are not in favor of a too high-pitch female voice, it can be expected to have a negative effect when teaching a quantitative course. This aspect will be explored in the main study.

Main Study

Previous research on professor evaluations have looked at variables of attractiveness, gender, workload, class difficulty, and overall professor effectiveness. However, research has not explored how voice pitch of the professor may impact a student's impression and rating of the professor. This study examines if a professor's voice pitch can also affect a student's evaluation of the professor in quantitative or non-quantitative courses. With the rise in online teaching, this study can contribute to academia in understanding relationship of voice pitch to student satisfaction. Though this study explores professor evaluations, it may have many implications outside of the academic setting. For example, this study may also serve to benefit the crisis communication in clinical psychology. If a voice pitch has a more positive response rate, perhaps it would be beneficial to include more voice pitches that are conducive to client's needs. Perhaps voice pitch may also contribute to psychologists' understanding of demeanors to teach clientele therapeutic techniques.

This study examines voice pitch, gender, and subject matter to determine if voice pitch contributes to a student's overall evaluation of a professor. These evaluations are based on a combination of two evaluations: Presentation Evaluation and a Professor Evaluation. Both of these evaluations are further based upon three components: the student's perception of the professionalism of the professor/presentation, student's desire to have a future interaction with the professor, and student's perception of learning with the professor/presentation. Additionally, a Voice Evaluation is included in the study to further analyze the voice characteristics of each group.

Regarding scores on the combined Presentation and Professor Evaluation, it is hypothesized:

1) High-pitched voices will result in higher scores on professor evaluations than the low-pitched voices (Samoza, Sugay, Arellano, & Custodio, 2015).

2) Male professor voice will receive higher scores on the professor evaluation than the female professor voices (Arbuckle & Williams, 2003).

3) The non-quantitative course will result in a higher score on the professor evaluation in comparison to the quantitative course (Uttl & Smibert, 2017).

Furthermore, this study will explore the possible interaction of voice pitch and subject matter to further explore how a non-quantitative class taught by high-pitched voices will affect a professor's evaluation in comparison to the low-pitched voices of a non-quantitative class and the differing voice pitches of the quantitative class. Additionally, this study will explore how the non-quantitative class and the quantitative class taught by differing genders may result in alternative professor evaluations.

Regarding student learning and comprehension of the material, it is hypothesized:

1) High-pitched voices will result in higher quiz scores than the low-pitched voices (Samoza, Sugay, Arellano, & Custodio, 2015).

2) No difference in quiz scores is predicted based on the gender of a professor (Helfrich & Weidenbecher, 2011; Somoza, Sugay, Arellano, & Custodio, 2015).

3) Classes focused on the non-quantitative course will have higher quiz scores than quiz scores for the classes focused on the quantitative course (Centra, 2003; Uttl & Smibert, 2017).

Furthermore, this study will explore the possible interaction of voice pitch and subject matter to further demonstrate how a non-quantitative class taught by high-pitched voices will affect a student's learning in comparison to the low-pitched voices of a non-quantitative class and the differing voice pitches of the quantitative class. Lastly, this study will explore how the non-quantitative class and the quantitative class taught by differing genders may have an effect on a student's learning.

METHOD

Participants

267 participants (Male: 78, Female: 177, other: 12) were recruited from General Education courses from a small Midwestern university. They were mostly Caucasian (77.5%), followed by Hispanic (13.5%), African American (4.9%), Other (1.9%), Native American (1.5%), and Asian American (.7%). The majority of the students were First Years (41.6%), followed by Second Years (28.8%), Third Years (10.9%), Fourth Years (9%), Fifth Years (1.9%), and Sixth + Years (.7%). As following the ethical guidelines, participants were over the age of 18 and under the age of 65 ranging from 18-40 (M = 19.97, SD = 2.57). Participants' majors were mostly Social Science (33%), followed by Health (30.3%), Natural Science (10.1%), Education (9%), Business (7.1%), Arts (4.5%), Technology Majors (4.5%), Other (1.1%), and Mathematics (.4%). All APA ethical guidelines were closely followed in this study.

Materials

To control for gender attraction, age attraction, and biases of the participant, the study was not done through observing on-campus classes with familiar professors. Instead, participants randomly watched one of eight presentations (see Design and Procedure), which are voice recordings embedded into PowerPoint slides to mimic an online class. The PowerPoint slides were created similar to those used in the pilot study. The voice recordings were recorded in a studio to control for external noises in the recordings. To further control familiarity bias, the recordings were of one female and one male from a separate university. Each, the female and the male, recorded from a script for

the quantitative course with a focus on the concept of standard deviation, and from a script for the non-quantitative course of the social sciences with a focus on generalized anxiety disorder. To reduce error for differences in voice fluctuation, the same male and female recording for each script were used to make the presentation. To do this, the same recordings were used but were altered by raising or lowering the pitch. To control for having a technical sound, both voices were raised and lowered so there would be 540 Cents between each gender's high- and low-pitch. That is, the female high-pitch was raised 330 Cents and the low-pitch was lowered -210 Cents. The male high-pitch was raised 380 Cents and the low-pitch was lowered -160 Cents. As another control variable, both scripts underwent a pilot run and were both approximately seven minutes long.

This study also used a self-created voice evaluation and professor evaluation questionnaire similar to the ones used in the Pilot Study. The voice evaluation is a fourteen-question evaluation that asks participants to rate each question on a seven-point Likert scale ranging from 1 (Strongly Disagree) to 7 (Strongly Agree). For example, "The presenter had a high-pitched voice" and "The presenter had a low-pitched voice". The professor evaluation is a twenty-three question evaluation that asks participants to rate each question on a seven point Likert scale ranging from 1 (Strongly Disagree) to 7 (Strongly Agree). For example, "I feel the presenter was interesting" and "I feel the presenter had a logical presentation". The presentation evaluation is a nine question presentation evaluation that asks participants to rate each question on a seven-point Likert scale ranging from 1 (Strongly Disagree) to 7 (Strongly Agree). For example, "I feel the subject matter was difficult to understand." Participants also completed one of the self-

created five, multiple-choice question memory quiz that evaluates participants' learning. Finally, participants completed a demographics sheet.

Design and Procedure

This study followed a 2 (Sex: male, female) x 2 (Voice Pitch: high, low) x 2 (Lesson Taught: standard deviation, generalized anxiety disorder) between-subjects experimental design condition with professor evaluation and quiz score as main dependent variable. Additional exploratory analyses were conducted over voice evaluation and presentation evaluation.

Upon consent, participants watched one of the eight PowerPoint presentations that were randomly selected for each class: male: high-pitch, standard deviation (*N*= 40), male: low-pitch, standard deviation (*N*= 38), female: high-pitch, standard deviation (*N*= 25), female: low-pitch, standard deviation (*N*= 36), male: high-pitch, generalized anxiety disorder (*N* = 30), male: low-pitch, generalized anxiety disorder (*N*= 37), female: high-pitch, generalized anxiety disorder, (*N*= 31), and finally female: low-pitch, generalize anxiety disorder (*N*= 30). Upon completion of the video presentation, participants were handed a series of evaluation questionnaires regarding presentation style, professionalism, and voice characteristics. Once each of the evaluations were completed, participants answered a demographic survey and five question quiz on the lecture. When the packet was finished, participants were thanked for their participation and debriefed.

Though data was collected on campus, the design and method of the study simulated an online class structure, therefore providing stronger implications to online classes rather than on-campus classes.

RESULTS

A manipulation check was conducted between high-pitch and low-pitch for both male professors and female professors to determine if participants could perceive a difference between high- and low-pitch. The manipulation check showed a significant difference between male low-pitch ($M = 3.32$, $SD = 1.88$) and male high-pitch ($M = 7.57$, $SD = 2.67$), $F(1, 143) = 124.20$, $p < .000$, $\eta^2 = .46$. Additionally, a manipulation check showed a significant difference between female low-pitch ($M = 7.18$ $SD = 3.37$) and female high-pitch ($M = 11.98$, $SD = 1.97$), $F(1, 120) = 88.11$, $p < .000$, $\eta^2 = .42$. A manipulation check was also conducted to determine if participants could distinguish a difference between the gender of the professor, which was determined by asking the participants, *"This professor was a Male/Female"*. The manipulation check had shown a significant difference between recognition of gender for male ($M = 1.03$, $SD = .16$) and female ($M = 1.85$, $SD = .36$), $F(1, 265) = 621.11$, $p < .000$, $\eta^2 = .701$ based on the voice sample.

Cronbach's alpha was conducted to determine reliability of the teaching evaluation consisting of the 9-item presentation evaluation and the 21-item professor evaluation. The reliability of the combined 30-item teaching evaluation was $\alpha = .96$. Cronbach's alpha was also conducted to determine reliability of the voice evaluation, which consisted of 12 items ($\alpha = .91$).

Cronbach's alpha was also conducted to determine reliability of the three subcategories of the professor evaluation. The reliability of the subcategory professionalism ($N = 7$) was $\alpha = .83$. The reliability of the subcategory perception of

learning ($N = 7$) was $\alpha = .89$. The reliability of the subcategory future interaction ($N = 7$) was $\alpha = .92$.

The Effect of Pitch, Gender, and Subject on Professor Evaluation

A 2x2x2 Univariate Analysis of Variance (ANOVA) was run to examine the effect of pitch (high, low), gender (male, female), and subject being taught (generalized anxiety disorder, standard deviation) on professor evaluation. The results of the ANOVA showed a significant main effect for gender of the professor. There was a significant difference between male ($M = 129.39$, $SD = 27.16$) and female professor ($M = 119.07$, $SD = 30.09$), $F(1, 259) = 9.85$, $p = .002$, $\eta^2 = .037$. (See Figure 2).

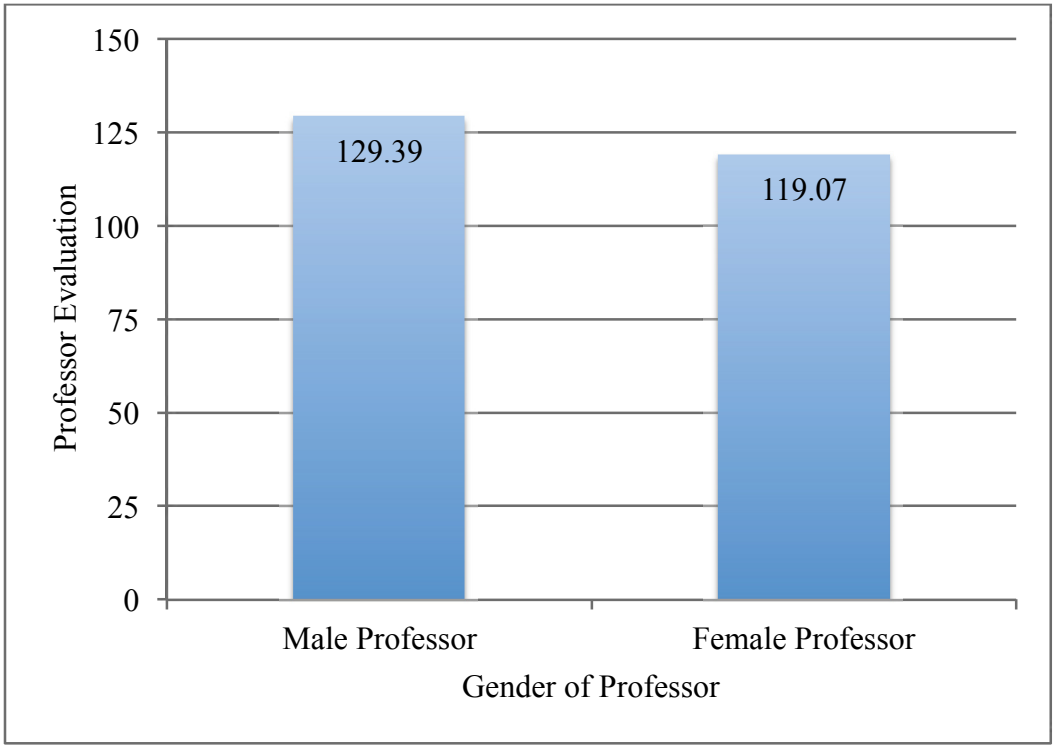

Figure 2. Professor Evaluation Based on Gender of Professor. Mean scores representing professor evaluation scores of male and female professors.

The results of the ANOVA showed a significant main effect between subjects. generalized anxiety disorder (M = 128.45, SD = 29.66) showed significantly higher evaluation than standard deviation (M = 121.19, SD = 27.93), $F(1, 259) = 4.43$, $p = .036$, $\eta^2 = .017$.

The results of the ANOVA also showed a significant main effect between high-pitch (M = 128.65, SD = 27.20) and low-pitch (M = 121.11, SD = 30.07), $F(1, 259) = 5.11$, $p = .025$, $\eta^2 = .019$. (See Figure 3).

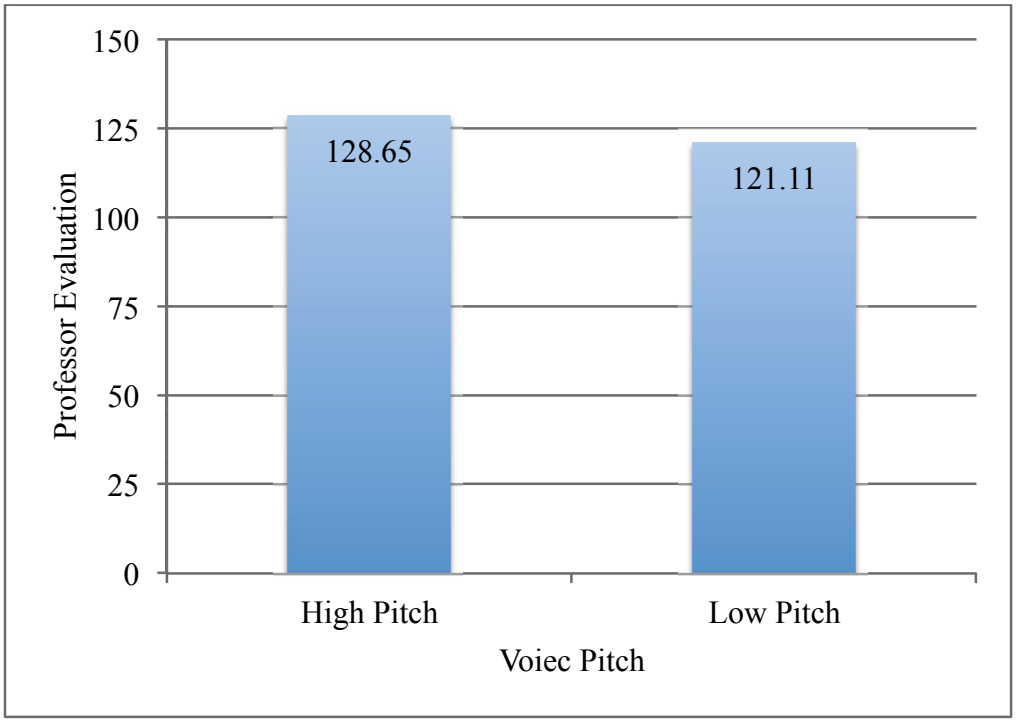

Figure 3. Professor Evaluation Based on Voice Pitch. Mean scores representing professor evaluation scores of professors with high-pitched voice and low-pitched voice.

The results of the ANOVA did not have a significant interaction effect on professor evaluation between professor gender and subject, $F(1, 259) = 1.86$, $p = .17$, $\eta^2 = .007$, which is a small effect size. The results of the ANOVA did not have a significant interaction effect on professor evaluation between professor gender and pitch, $F(1, 259) = .65$, $p = .42$, $\eta^2 = .002$, which is a small effect size. The results of the ANOVA did not have a significant interaction effect on professor evaluation between subject and pitch, $F(1, 259) = 1.94$, $p = .17$, $\eta^2 = .007$, which is a small effect size.

The results of the ANOVA did not have a significant three-way interaction effect on professor evaluation between pitch, professor gender, and subject $F(1, 259) = 1.48$, $p = .23$, $\eta^2 = .006$. (See Table 1 for complete professor evaluation *M* and *SD* of each condition).

Table 1.

Professor Evaluation Mean Scores of Each Condition

	High-Pitch				Low-Pitch			
	GAD		SD		GAD		SD	
Gender	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Male	140.43	22.95	126.81	25.11	133.71	24.92	123.08	31.15
Female	130.19	32.09	118.70	23.44	110.50	30.31	116.97	31.04

Note. GAD = Generalized Anxiety Disorder; SD = Standard Deviation. All values equal raw non-standardized scores.

The Effect of Pitch, Gender, and Subject on Subcategory: Professionalism

A 2x2x2 Univariate Analysis of Variance (ANOVA) was run to look at the effect of pitch (high, low), gender (male, female), and subject being taught (generalized anxiety disorder, standard deviation) on the professor evaluation subcategory of professionalism (See Table 2).

The results of the ANOVA only showed significance in two main effects regarding professionalism. The results showed a significant main effect between high-pitch (M = 33.37, SD = 6.27) and low-pitch (M = 31.13, SD = 6.63), $F(1, 259) = 8.71$, $p = .003$, $\eta^2 = .03$. The results of the ANOVA also showed a significant main effect between male (M = 33.26, SD = 6.01) and female professor (M = 30.92, SD = 6.94), $F(1, 259) = 9.45$, $p = .002$, $\eta^2 = .04$.

Table 2.

Subcategory: Professionalism Mean Scores in Each Condition

Male				Female			
High-Pitch		Low-Pitch		High-Pitch		Low-Pitch	
GAD	SD	GAD	SD	GAD	SD	GAD	SD
M (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)
35.07 (5.99)	33.48 (5.63)	33.46 (5.88)	31.42 (6.26)	32.81 (7.25)	31.88 (6.13)	28.13 (6.80)	30.94 (6.84)

Note. GAD = Generalized Anxiety Disorder; SD = Standard Deviation. All values equal raw non-standardized scores.

The Effect of Pitch, Gender, and Subject on Subcategory: Perception of Learning

A 2x2x2 Univariate Analysis of Variance (ANOVA) was run to look at the effect of (high, low), gender (male, female), and subject being taught (generalized anxiety disorder, standard deviation) on the professor evaluation subcategory of perception of learning (See Table 3).

The results of the ANOVA had only shown a significant main effect for gender. Students perceived higher learning when taught by a male professor ($M = 28.45$, $SD = 7.89$) than a female professor ($M = 25.41$, $SD = 8.71$), $F(1, 259) = 9.78$, $p = .002$, $\eta^2 = .04$.

Table 3.

Subcategory: Perception of Learning Mean Scores in Each Condition

Male				Female			
High-Pitch		Low-Pitch		High-Pitch		Low-Pitch	
GAD	SD	GAD	SD	GAD	SD	GAD	SD
M (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)
30.10 (8.04)	27.68 (7.93)	29.16 (7.48)	27.26 (8.15)	28.10 (9.81)	25.20 (6.70)	22.57 (7.93)	25.61 (9.13)

Note. GAD = Generalized Anxiety Disorder; SD = Standard Deviation. All values equal raw non-standardized scores.

The Effect of Pitch, Gender, and Subject on Subcategory: Future Interaction

A 2x2x2 Univariate Analysis of Variance (ANOVA) was run to look at the effect of (high, low), gender (male, female), and subject being taught (generalized anxiety

disorder, standard deviation) on the professor evaluation subcategory of future interaction (See Table 4).

The results of the ANOVA had only shown significance in two main effects. The results showed a significant main effect between high-pitch (M = 28.06, SD = 7.00) and low-pitch (M = 25.74, SD = 9.11), $F(1, 259) = 5.52$, $p = .02$, $\eta^2 = .02$. The results of the ANOVA had also shown a significant main effect between male (M = 28.04, SD = 7.67) and female professor (M = 25.40, SD = 8.7), $F(1, 259) = 7.42$, $p = .007$, $\eta^2 = .03$.

Table 4.

Subcategory: Future Interaction Mean Scores in Each Condition

Male				Female			
High-Pitch		Low-Pitch		High-Pitch		Low-Pitch	
GAD	SD	GAD	SD	GAD	SD	GAD	SD
M (SD)	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*
30.87 (5.98)	27.93 (6.39)	29.24 (7.23)	24.76 (9.41)	26.74 (8.49)	26.52 (6.38)	24.27 (9.36)	24.42 (9.73)

Note. GAD = Generalized Anxiety Disorder; SD = Standard Deviation. All values equal raw non-standardized scores.

The Effect of Pitch, Gender, and Subject on Quiz Scores

A 2x2x2 Univariate Analysis of Variance (ANOVA) was run to look at the effect of pitch (high, low), gender (male, female), and subject being taught (generalized anxiety disorder, standard deviation) on quiz scores. The results of the ANOVA did not show a

significant main effect for quiz score between male professor ($M = 3.74$, $SD = 1.20$) and female professor ($M = 3.75$, $SD = 1.13$), $F(1, 259) = .002$, $p = .96$, $\eta^2 < .000$, which is a small effect size. The results of the ANOVA did show a significant main effect of quiz score between the subject generalized anxiety disorder ($M = 3.91$, $SD = 1.05$) and standard deviation ($M = 3.60$, $SD = 1.25$), $F(1, 259) = 6.45$, $p = .012$, $\eta^2 = .024$, which is a small effect size. The results of the ANOVA did not show a significant main effect for quiz score between high-pitch ($M = 3.71$, $SD = 1.24$) and low-pitch ($M = 3.78$, $SD = 1.10$), $F(1, 259) = .83$, $p = .36$, $\eta^2 = .003$, which is a small effect size.

The results of the ANOVA did have a significant interaction effect on quiz score between professor gender and subject, $F(1, 259) = 15.80$, $p = .000$, $\eta^2 = .057$, which is a medium effect size. To further analyze the two-way interaction, a simple effect test was conducted. Within the male professor condition, the difference between the generalized anxiety disorder condition ($M = 3.64$, $SD = 1.15$) and the standard deviation condition ($M = 3.83$, $SD = 1.24$) was not statistically significant: $F(1, 144) = .92$, $p = .34$. Within the female professor condition, the difference between the generalized anxiety disorder condition ($M = 4.20$, $SD = .85$) showed significantly higher quiz score than the subject standard deviation condition ($M = 3.30$, $SD = 1.20$), $F(1, 121) = 22.83$, $p < .001$. (See Figure 4).

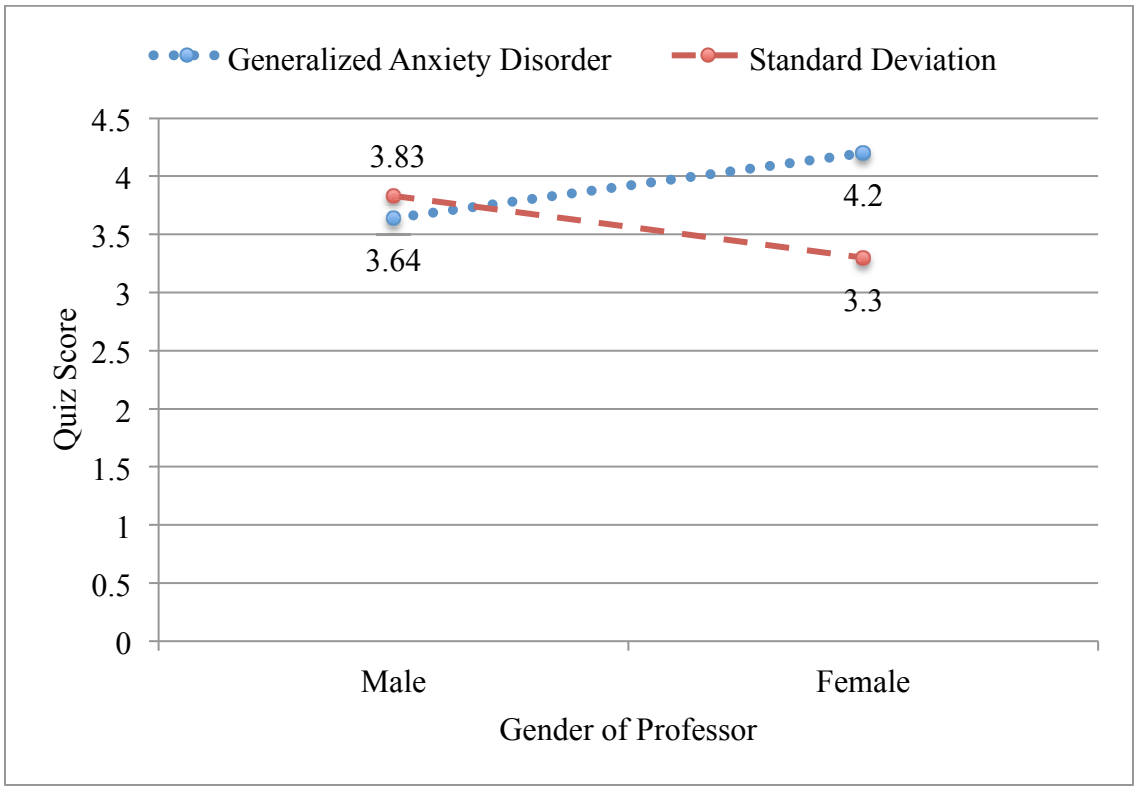

Figure 4. Quiz Score Based on Professor Gender and Subject Taught. Mean scores representing Quiz Scores of participants who were taught Generalized Anxiety Disorder by Male Professor, Standard Deviation by Male Professor, Generalized Anxiety Disorder by Female Professor, Standard Deviation by Female Professor. Significance was found between the female professor: standard deviation and generalized anxiety disorder groups.

The results of the ANOVA did not have a significant interaction effect on quiz score between professor gender and pitch, $F(1, 259) = .023$, $p = .88$, $\eta^2 < .000$, which is a small effect size. The results of the ANOVA did not have a significant interaction effect on quiz score between subject and pitch, $F(1, 259) = .08$, $p = .78$, $\eta^2 < .000$, which is a small effect size. The results of the ANOVA did not have a significant interaction effect

on quiz score between pitch, professor gender, and subject $F(1, 259) = .13$, $p = .72$, $\eta^2 = .001$, which is a small effect size. (See Table 2 for complete quiz score *M* and *SD* of each condition).

Table 5.

Quiz Mean Scores of Each Condition

	High				Low			
	GAD		SD		GAD		SD	
Gender	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Male	3.54	1.26	3.95	1.05	3.74	1.02	3.89	1.26
Female	4.13	.85	3.26	1.29	4.27	.87	3.36	1.02

Note. GAD = Generalized Anxiety Disorder; SD = Standard Deviation. All values equal raw non-standardized scores.

Means of Evaluation Questions

In addition to the hypotheses testing, Tables 6-8 identify significant means of scores of individual evaluation questions from the presentation evaluation (Table 6), professor evaluation (Table 7), and voice evaluation (Table 8) between male and female professors, high- and low-pitch, and generalized anxiety disorder and standard deviation subjects.

Table 6.

Mean Scores of Voice Evaluation Questions

	Male	Female	High	Low	GAD	SD
Q	*M* *(SD)*	*M* *(SD)*	*M* *(SD)*	*M* *(SD)*	*M* *(SD)*	*M* *(SD)*
a	3.53 (1.48)	2.80 (1.42)	3.47 (1.41)	2.96 (1.53)	3.19 (1.55)	3.21 (1.45)
b	5.21 (1.09)	4.48 (1.66)	4.87 (1.33)	4.88 (1.51)	4.77 (1.54)	4.97 (1.32)
c	3.94 (1.47)	3.20 (1.46)	3.90 (1.49)	3.34 (1.48)	3.58 (1.57)	3.63 (1.45)
d	3.55 (1.41)	2.90 (1.40)	3.32 (1.38)	3.20 (1.49)	3.27 (1.50)	3.24 (1.38)
e	4.42 (1.51)	3.93 (1.55)	4.55 (1.48)	3.88 (1.54)	4.34 (1.49)	4.06 (1.59)
f	3.05 (1.46)	2.61 (1.35)	3.03 (1.41)	2.68 (1.42)	2.84 (1.48)	2.86 (1.38)
g	3.68 (1.65)	5.02 (1.58)	4.07 (1.83)	4.49 (1.64)	4.34 (1.78)	4.24 (1.72)
h	4.08 (1.55)	2.70 (1.40)	2.88 (1.41)	3.96 (1.65)	3.38 (1.72)	3.51 (1.54)
i	4.04 (1.30)	4.07 (1.50)	4.38 (1.34)	3.76 (1.38)	4.26 (1.42)	3.86 (1.35)
j	4.39 (1.23)	4.21 (1.31)	4.38 (1.30)	4.25 (1.24)	4.35 (1.24)	4.27 (1.29)
k	4.14 (1.33)	3.75 (1.46)	4.09 (1.42)	3.85 (1.39)	4.02 (1.36)	3.91 (1.45)
l	4.54 (1.14)	4.57 (1.43)	4.76 (1.29)	4.37 (1.24)	4.66 (1.25)	4.46 (1.31)

Note. PA = Voice Evaluation Questions; GAD = Generalized Anxiety Disorder; SD = Standard Deviation; a = I feel the professor had an appealing voice; b = I feel the professor had a calm voice; c = I feel the professor had a pleasant voice; d = I feel the professor had a persuasive voice; e = I feel the professor had an approachable voice; f = I feel the professor had an attractive voice; g = I feel the professor had an annoying voice; h = I feel the professor had an authoritative voice; i = I feel the professor had a caring

voice; j = I feel the professor had a trustworthy voice; k = I feel the professor had a meaningful voice; l = I feel the professor had a kind voice. All values equal raw non-standardized scores.

Table 7.

Mean Scores of Professor Evaluation Questions.

	Male	Female	High	Low	GAD	SD
Q	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*
a	6.06 (.80)	5.77 (1.12)	5.98 (.89)	5.88 (1.03)	5.82 (.99)	6.02 (.94)
b	3.68 (1.65)	3.10 (1.75)	3.74 (1.73)	3.13 (1.66)	3.45 (1.81)	3.39 (1.64)
c	5.43 (1.12)	5.07 (1.37)	5.40 (1.13)	5.15 (1.35)	5.34 (1.30)	5.19 (1.22)
d	3.28 (1.55)	3.00 (1.70)	3.56 (1.64)	2.79 (1.52)	3.25 (1.68)	3.06 (1.57)
e	5.20 (1.25)	4.80 (1.47)	5.08 (1.24)	4.96 (1.47)	4.97 (1.63)	5.06 (1.37)
f	3.31 (1.58)	2.82 (1.51)	3.27 (1.58)	2.92 (1.54)	3.20 (1.58)	2.98 (1.55)
g	5.50 (1.06)	5.22 (1.19)	5.46 (1.00)	5.30 (1.22)	5.41 (1.07)	5.35 (1.18)
h	3.23 (1.48)	3.05 (1.53)	3.31 (1.48)	3.01 (1.51)	3.30 (1.56)	3.01 (1.43)
i	4.41 (1.51)	3.65 (1.72)	4.18 (1.62)	3.95 (1.68)	4.13 (1.70)	4.00 (1.61)
j	3.59 (1.49)	4.16 (1.76)	3.73 (1.59)	3.96 (1.69)	3.84 (1.63)	3.86 (1.65)
k	4.30 (1.40)	4.10 (1.58)	4.32 (1.49)	4.11 (1.48)	4.25 (1.51)	4.17 (1.46)
l	4.64 (1.72)	5.12 (1.74)	4.88 (1.59)	4.84 (1.87)	4.80 (1.70)	4.91 (1.79)
m	4.52 (1.10)	4.10 (1.31)	4.48 (1.16)	4.18 (1.25)	4.41 (1.26)	4.25 (1.17)
n	5.02 (1.08)	4.93 (.99)	5.07 (1.04)	4.90 (1.04)	5.13 (1.07)	4.84 (1.00)
o	3.61 (1.68)	4.16 (1.84)	3.75 (1.61)	3.96 (1.91)	3.67 (1.78)	4.03 (1.75)
p	3.81 (1.23)	3.53 (1.44)	3.91 (1.15)	3.48 (1.45)	3.87 (1.41)	3.51 (1.24)
q	4.06 (1.27)	3.59 (1.40)	4.03 (1.25)	3.67 (1.41)	3.92 (1.36)	3.77 (1.33)
r	3.71 (1.46)	4.07 (1.68)	3.71 (1.36)	4.02 (1.73)	3.71 (1.50)	4.03 (1.63)

s	3.70	3.30	3.72	3.33	3.71	3.34
	(1.32)	(1.34)	(1.19)	(1.44)	(1.29)	(1.37)
t	4.16	3.86	4.13	3.92	4.13	3.93
	(1.28)	(1.31)	(1.22)	(1.37)	(1.26)	(1.34)
u	3.63	3.35	3.71	3.32	3.61	3.41
	(1.19)	(1.41)	(1.17)	(1.39)	(1.32)	(1.28)

Note. Q = Professor Evaluation Questions; GAD = Generalized Anxiety Disorder; SD = Standard Deviation; a = I feel the professor was knowledgeable about the subject matter; b = I feel the professor was pleasant to listen to; c = I feel the professor clearly communicated the information; d = I feel the professor was enthusiastic about the subject material; e = I feel the professor was confident in his or her presentation; f = I feel the professor was engaging; g = I feel the professor was intelligent; h = I feel the professor was interesting; i = I feel the professor had a strong presentation; j = I feel the professor had a weak presentation; k = I feel the professor had an effective presentation; l = I feel the professor was boring; m = I feel the professor is likable; n = I feel the professor is competent; o = I feel I would avoid this professor; p = I feel I would like to get to know this professor; q = I feel this professor would make me feel at ease; r = I feel this professor would be difficult to talk to; s = I feel I would like to work with this professor; t = I feel this professor would make a great professor; u = I feel this professor would be a popular professor. All values equal raw non-standardized scores.

Table 8.

Mean Scores of Voice Evaluation Questions

	Male	Female	High	Low	GAD	SD
Q	*M* *(SD)*	*M* *(SD)*	*M* *(SD)*	*M* *(SD)*	*M* *(SD)*	*M* *(SD)*
a	3.53 (1.48)	2.80 (1.42)	3.47 (1.41)	2.96 (1.53)	3.19 (1.55)	3.21 (1.45)
b	5.21 (1.09)	4.48 (1.66)	4.87 (1.33)	4.88 (1.51)	4.77 (1.54)	4.97 (1.32)
c	3.94 (1.47)	3.20 (1.46)	3.90 (1.49)	3.34 (1.48)	3.58 (1.57)	3.63 (1.45)
d	3.55 (1.41)	2.90 (1.40)	3.32 (1.38)	3.20 (1.49)	3.27 (1.50)	3.24 (1.38)
e	4.42 (1.51)	3.93 (1.55)	4.55 (1.48)	3.88 (1.54)	4.34 (1.49)	4.06 (1.59)
f	3.05 (1.46)	2.61 (1.35)	3.03 (1.41)	2.68 (1.42)	2.84 (1.48)	2.86 (1.38)
g	3.68 (1.65)	5.02 (1.58)	4.07 (1.83)	4.49 (1.64)	4.34 (1.78)	4.24 (1.72)
h	4.08 (1.55)	2.70 (1.40)	2.88 (1.41)	3.96 (1.65)	3.38 (1.72)	3.51 (1.54)
i	4.04 (1.30)	4.07 (1.50)	4.38 (1.34)	3.76 (1.38)	4.26 (1.42)	3.86 (1.35)
j	4.39 (1.23)	4.21 (1.31)	4.38 (1.30)	4.25 (1.24)	4.35 (1.24)	4.27 (1.29)
k	4.14 (1.33)	3.75 (1.46)	4.09 (1.42)	3.85 (1.39)	4.02 (1.36)	3.91 (1.45)
l	4.54 (1.14)	4.57 (1.43)	4.76 (1.29)	4.37 (1.24)	4.66 (1.25)	4.46 (1.31)

Note. PA = Voice Evaluation Questions; GAD = Generalized Anxiety Disorder; SD = Standard Deviation; a = I feel the professor had an appealing voice; b = I feel the professor had a calm voice; c = I feel the professor had a pleasant voice; d = I feel the professor had a persuasive voice; e = I feel the professor had an approachable voice; f = I feel the professor had an attractive voice; g = I feel the professor had an annoying voice; h = I feel the professor had an authoritative voice; i = I feel the professor had a caring

voice; j = I feel the professor had a trustworthy voice; k = I feel the professor had a meaningful voice; l = I feel the professor had a kind voice. All values equal raw non-standardized scores.

DISCUSSION

Professor Evaluation Hypotheses

Hypothesis 1.1

It was hypothesized professors across both genders with overall high-pitched voices will result in higher ratings on the professor evaluations in comparison to overall low-pitched voices, similar to the findings found in Samoza, Sugay, Arellano, and Custodio (2015) study. This first hypothesis was supported; professors across both genders with overall high-pitched voices did receive higher scores on the professor evaluation compared to professors with low-pitched voices. These results were contradictory of the pilot study that had insignificant trends of low-pitched voices scoring higher than the high-pitched voices. This significant change could be due to the control of the extraneous variable of self-manipulation rather than the technical voice manipulation done in this main study.

Higher scores on professor evaluations for high-pitched voices also contradicts the Helfrich and Weidenbecher (2011) study, which portrayed the ratings of low-pitched voices more positively than high-pitched voices. It was concluded that these results may have been due to the emotional associations to the differing pitches. That is to say, the low-pitched voices were perceived to be more agreeable and the high-pitched voices had higher levels of disagreeableness. In this current study, however, high-pitched voices were perceived to be more appealing, pleasant, approachable, attractive, caring, and kind. The current finding of high-pitched voices leading to higher scores on professor evaluations suggests an interesting discussion point. This finding may be explained by

breaking down the professor evaluation to examine the individual components. For the presentation itself, students perceived the high-pitched voices as having a more professional presentation than the low-pitched voice. Additionally, students who listened to the high-pitched voices had a greater perception of learning than the students taught by the low-pitched voices. Previous studies have indicated one of the leading variables in the evaluation of a professor is overall learning (Centra & Gaubatz, 2005). Therefore, since students felt as if they learned more in the classes taught by the high-pitched voices, it is expected that high-pitch would have higher professor evaluation scores.

In addition to students having a higher perception of learning, students perceived the high-pitched professors as more pleasant to listen to, enthusiastic, popular, and likable. The high-pitched professors had also received significantly higher scores for future interaction compared to the low-pitched professors. Students felt more at ease with the high-pitched voices, and they felt they would like to get to know the professor and work with the professor.

Prior research has indicated personality characteristics of low-pitched voices as being more pleasant, persuasive, masculine, assertive, authoritative, confident, convincing, intelligent, reliable, trustworthy, truthful, (Dey, Freinberg, & Kim, 2009) attractive (Collins, 2000), and dominant (Puts, Hodges, Cardenas, & Gaulin, 2007; Dey, Freinberg, & Kim, 2009; Jones, Feinberg, DeBruine, Little, & Vukovic, 2010). With all of these characteristics in mind, one would believe that the low-pitch voices would potentially have higher scores than the high-pitch voices. However, previous research also indicates “best” professors are perceived to be caring, interesting, helpful,

knowledgeable, and fair (Basow, 2000), while more attractive professors receive higher evaluations (Riniolo, Johnson, Sherman, & Misso, 2006; Romano & Bordieri, 1989). Perhaps in the realm of education, students prefer the high-pitched voices because they sound more pleasant, approachable, attractive, appealing, caring and kind. Unlike the political environment, where dominance may be necessary, the educational environment wants to encourage students to approach the professors, ask questions, and support the learning experience.

Another factor possibly affecting the student's perception of professors is age. An individual's voice pitch naturally lowers over time, suggesting that age and voice pitch share an inverse relationship. In this study, professors with high-pitched voices were perceived as being younger. Perhaps, students feel high-pitched professors are closer to their own age and, therefore, feel a stronger association of listening to a peer rather than a professor. This explanation would also coincide with Basow's (2000) and Arbuckle and Williams's (2003) studies, which found that students favored younger educators. Furthermore, in this study, the younger professors were viewed as more enthusiastic and engaging than the perceptually older professors, who had lower-pitched voices. With this discovery in mind, perhaps the phenomenon of voice lowering over time would partially explain why the high-pitch voice scored higher than the low-pitch voice in this experiment.

Hypothesis 1.2

In this study, the second hypothesis--male professors will receive higher scores on the professor evaluation than female professors--was supported. As indicated in Arbuckle

and Williams, (2003), MacNell, Driscoll, & Hunt, (2014), and the pilot studies, male professors received higher scores on the professor evaluation than their female counterparts. Prior studies have indicated that there is a bias towards female professors (Romano & Bordieri, 1989) particularly when female students rate female professors (Bachen, McLoughlin, & Garcia, 1999; Basow, 2000; Centra & Gaubatz, 2000). However, prior studies have also indicated gender biases occur in which male students tend to prefer male faculty and female students prefer female faculty (Young, Rush & Shaw, 2009).

When hypothesizing possibilities for this outcome, it is best to examine the characteristics associated with this significance in the evaluation questions and the demographics of the students. First, it is important to note that the majority of the current participants were female. However, this demographic did not necessarily have an effect on the evaluations, though it may have played a part in the perception of the attractiveness of the professor.

To determine if these results were explained by attraction, the gender of student to gender of the professor was analyzed to see if attraction played a role in the decision making of the ranking of the professor in the evaluations. The results of this study showed that the female professor was preferred by both male and female participants. Though attraction played no role in the student's evaluation of the male professor, it is possible attraction contributed in the male student's evaluation of the female professor, as was the case in previous studies done by Collins (2000) and Jones (2010). These results also follow similar results to Bachen, McLoughlin, and Garcia, (1999), Basow, (2000),

and Centra and Gaubatz, (2000) studies where female students rated female professors more favorably than male professors.

Secondly, when looking at the individualized questions, male professors were viewed as having more professional professor characteristics. Students felt a higher perception of learning and a more positive presentation from male professors. In comparison, female professors were perceived to be more boring and having a weaker presentation. Furthermore, students felt more comfortable with the male professors, whereas students wanted to avoid future interaction with the female professor.

Under these circumstances, the preference of male professors may also coincide with the characteristics associated with the voice. Similar to high-pitched voices, male professors were perceived to have more positive voice qualities. These positive characteristics are associated with higher professor evaluation scores as mentioned in the previous hypothesis related to pitch; however, these results may also be in part due to the traditional mindsets of students who participated in this study, as outlined in the limitations.

Hypothesis 1.3

The results from this study support both prior findings and the third hypothesis: professors who teach the non-quantitative course (generalized anxiety disorder) will have higher scores on the professor evaluation than the professors who teach the quantitative course (standard deviation). Prior research has indicated a student's interest in taking courses such as statistics is nearly six standard deviations below a student's interest in taking a non-quantitative course (Uttl, White, & Morin, 2013). Additionally, the results

of this study are in congruence with a previous study that looked at courses in the natural sciences and humanities, identifying a much lower average overall evaluation of the humanities courses (Centra, 2009).

In previous studies, this higher professor evaluation score could be attributed to the higher level of student preparation and effort, or even interest in the material (Centra, 2009; Centra,& Gaubatz, 2005). There is also support that teaching a challenging class (such as math, biology, chemistry, or physics) requires a student to exhibit more effort and preparation, which may than result in a lower overall evaluation of the professor (Thornton, Adams, & Sepehri, 2010). In this study, students had preferred the generalized anxiety disorder classes because the presentations kept the students' attention, was easier to understand, and was more interesting. Additionally, the professors who taught the generalized anxiety disorder classes were perceived to be more competent and caring than the professors who taught the standard deviation classes. Finally, the students felt that they would like to get to know and work with the professors who taught the generalized anxiety disorder class over those professors who taught the standard deviation class, even though it was the same person.

Student interests in the topic may have also been increased because the students may know someone who has generalized anxiety disorder, consequently giving them a stronger interest and being able to associate with the class lecture over the topic. Perhaps the students felt some sympathy, empathy, or interest towards those diagnosed with generalized anxiety disorder, unlike the case with numbers and standard deviation.

Exploratory Analysis 1

Though this study found significant differences between pitch (high, low), gender (male, female), and subject (generalized anxiety disorder, standard deviation), there was no significance among the three variables. One possible explanation to having no significant interaction effect may be due to the subjective nature of the evaluation. Many participants have their own preferences, ideas, and experiences as to what may make a positive professor. For example, one individual may view a male, low-pitch voice professor who teaches standard deviation to be dull and monotonous, but another individual who enjoys statistics would enjoy the class. This increase in interest in the class would, in turn, affect the professor evaluation in a positive manner. Thus, that male professor with the low-pitch voice will have an average professor evaluation.

Student Learning from Quiz Scores Hypotheses

Hypothesis 2.1

The first hypothesis--high-pitched voices will result in higher quiz scores than low-pitched voices--was not supported. Unlike the Samoza, Sugay, Arellano, and Custodio, (2015) study, this study found that voice pitch had no effect on a student's overall learning. Though students perceived themselves to have learned more from professors with high-pitched voices, there was no significant difference in the quiz scores between high and low-pitch. These results were similar to Dey, Feinberg, and Kim's (2009) study, which had not shown significant results but had indicated a trend in which low-pitched voices, scored higher on verbal comprehension than the high-pitched voices. However, these results could possibly be different from the Samoza, Sugay, Arellano,

and Custodio (2015) study because it had focused on more conceptual content (generalized anxiety disorder and standard deviation) rather than 50 random duo-syllabic words. Perhaps the results may have been different if the quizzes were longer or included topics that were not as familiar to the students.

Hypothesis 2.2

As with prior studies, the second hypothesis for quiz scores was supported. There was no significant difference in quiz scores based on the gender of the professor. While the gender of the professor may have a significant effect on a student's perception of the professor, it does not influence the learning environment and how much a student comprehends in online lectures. This is a positive aspect in the realm of education, signifying that the gender of the professor does not impact a student's ability to learn and comprehend the lecture.

Hypothesis 2.3

The third hypothesis regarding quiz scores was supported; the participants in the Generalized Anxiety Disorder class received significantly higher quiz scores than the participants in the Standard Deviation class. This significant difference may be present because of the factors associated with Generalized Anxiety Disorder. In this study, participants perceived the presentation in Generalized Anxiety Disorder as easier to understand, more interesting, and better able to keep their attention. Additionally, participants felt the Standard Deviation class was difficult to understand and confusing. This supports many previous studies indicating quantitative concepts are more difficult to

comprehend than the non-quantitative concepts (Uttl & Smibert, 2017; Uttle, White, & Morin, 2013).

Exploratory Analysis 2

The interaction effects of pitch, gender, and subject were observed to see if there was any significance of the quiz scores. In this study, there was no significance difference with pitch and subject, pitch and gender, or pitch, subject, and gender, but there was a significant interaction effect of gender and subject.

One possible outcome of these results may be traced to the norm and expectation of professors in STEM classes. STEM faculty gender proportions indicate the female to male faculty ratio is roughly two to three respectively (Hurtado & Figueroa, 2013). With the majority of STEM courses taught by men, students may be expected to favor the male voice when hearing about standard deviation, a more math based concrete class, and favor the female voice when hearing about generalized anxiety disorder, a more social science abstract class.

Limitations and Future Directions

Limitations to this study include the demographics of the participants. These data were collected from a small Midwestern university, and the male to female ratio for participants was one to two, respectively. This uneven gender ratio may have accounted for some of the results in the study. It would be advantageous for future studies to gather more data from a more diverse and inclusive population.

Another limitation to this study was the size of the study in combination with the size of the sample. This study was conducted at a small Midwestern university and

consisted of eight different conditions. Having several conditions, this study utilized every psychology class for participants. For this reason, it is possible some of the students had heard the study conducted in another class and still participated. To help control for this, students were asked not to participate in the study if they had previously heard or participated in the study. However, it is possible students participated in the study for a second time. The sampling consisted of many classes from the social sciences. This sampling was done to help control the population; however, future studies may want to explore using similar topics from other disciplines. Likewise, future studies may want to continue using participants from the social sciences but use lecture topics from other disciplines.

Another limitation to this study was that it only looked at high-pitch and low-pitch voice types for each gender. This study does not include a control group of neutral pitch for each gender. No neutral condition was used to help narrow the focus of voice pitch research; nevertheless, future studies may want to look into including the male and female neutral speaking voice. Future studies may also want to include different levels of the voice as it is raised and lowered. For example, rather than high or low, perhaps it can include low, med-low, neutral, med-high, and high.

A final limitation to this study lies within the study itself. This study compared female and male professors. Though great care was taken to control voice fluctuations and tempo, there had to be a separate recording for male and female voice. It was improbable to make both voices have the exact same voice fluctuations, emphasis, prosody, or tempo. A decision had to be made to make the voices sound very similar or

maintain authenticity of the voice. To avoid a voice sounding too robotic and technical, the decision was made to maintain voice authenticity to better simulate a real online lecture. With technology always changing, it may be interesting to see how the two voices may be digitally manipulated in the future to have similar prosody and inflections.

As previously mentioned, this study can have implications in the educational realm. It focuses on subjective factors that influence a student's evaluation of an online professor, but it also targets these factors and determines whether they influence a student's overall learning. Results of this study can be used by professors and educators alike in creating stronger online classes involving lectures. Additionally, results of this study can be used to further strengthen professor feedback and assist in promotional endeavors.

Furthermore, this study can make implications for future directions for the therapeutic realm. In therapy, it is not uncommon for the therapist to give the client a little psychology education. During this process, a therapist or provider can apply the results of this study to further help during the teaching process. However, it would be advantageous to further explore education to patients in the therapeutic realm. Finally, the results of this study could be used for direction of future studies involving crisis communication. Knowing more of the characteristics of pitch and how the collegiate population perceives voice pitch, future studies can look to see if voice pitch can impact the collegiate population during a crisis.

This study examined the following question: does voice pitch of opposing genders have an effect on a student's learning and professor's evaluation? It looked at a

professor's voice pitch (low, high), gender of a professor (male, female), and the subject topic taught (generalized anxiety disorder, standard deviation) to see how it would affect a professor's evaluation and how well students comprehended the simulated online lecture. This study found that pitch, gender of professor, and subject of class individually influence a student's evaluation of a professor; however, the interactions of these conditions have no effect on a professor's evaluation. This study also found that pitch and gender of professor do not influence a student's level of comprehension of an online lecture, but subject and the interaction of subject and gender of professor do affect a student's comprehension of an online lecture.

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Appendix A

Demographics

Gender (circle one): Male Female Other **Age:** _____

Ethnicity (check one that best applies to you):

___Caucasian
___African American
___Asian American
___Hispanic
___Native American
___Indian
___Other

Year in School: 1 2 3 4 5 6+

Major (check one that best applies to your major):

___Natural Science ____Social Science ____Education

___Business ____Technology ____Mathematics

___Health ____Arts

Appendix B

Presentation Evaluation

For each of the following, rate your reaction to the presentation that you just watched using the seven-point scale below.

1	2	3	4	5	6	7
Strongly Disagree	Disagree	Disagree somewhat	Neither Agree or Disagree	Agree somewhat	Agree	Strongly Agree

1. The lesson kept my attention throughout the presentation

1 2 3 4 5 6 7

2. I feel the presentation was professional

1 2 3 4 5 6 7

3. I feel I know more about the topic that was taught

1 2 3 4 5 6 7

4. I feel the presentation was difficult to understand

1 2 3 4 5 6 7

5. I feel the presentation was easy to understand

1 2 3 4 5 6 7

6. I feel the presentation was interesting

1 2 3 4 5 6 7

7. I feel the presentation was very well organized

1 2 3 4 5 6 7

8. I feel the presentation was boring

1 2 3 4 5 6 7

9. I feel the presentation was confusing

1 2 3 4 5 6 7

Appendix C

Professor Evaluation

For each of the following, rate the professor who gave the presentation using the seven-point scale below.

1	2	3	4	5	6	7
Strongly Disagree	Disagree	Disagree somewhat	Neither Agree or Disagree	Agree somewhat	Agree	Strongly Agree

1. I feel the professor was knowledgeable about the subject matter
   1 2 3 4 5 6 7

2. I feel the professor was pleasant to listen to
   1 2 3 4 5 6 7

3. I feel the professor clearly communicated the information
   1 2 3 4 5 6 7

4. I feel the professor was enthusiastic about the subject material
   1 2 3 4 5 6 7

5. I feel the professor was confident in his or her presentation
   1 2 3 4 5 6 7

6. I feel the professor was engaging
   1 2 3 4 5 6 7

7. I feel the professor was intelligent
   1 2 3 4 5 6 7

8. I feel the professor was interesting
   1 2 3 4 5 6 7

9. I feel the professor had a strong presentation
   1 2 3 4 5 6 7

10. I feel the professor had a weak presentation
    1 2 3 4 5 6 7

11. I feel the professor had an effective presentation
    1 2 3 4 5 6 7

12. I feel the professor was boring
1 2 3 4 5 6 7

13. I feel the professor is likable
1 2 3 4 5 6 7

14. I feel the professor is competent
1 2 3 4 5 6 7

15. I feel I would avoid this professor
1 2 3 4 5 6 7

16. I feel I would like to get to know this professor
1 2 3 4 5 6 7

17. I feel this professor would make me feel at ease
1 2 3 4 5 6 7

18. I feel this professor would be difficult to talk to
1 2 3 4 5 6 7

19. I feel I would like to work with this professor
1 2 3 4 5 6 7

20. I feel this professor would make a great professor
1 2 3 4 5 6 7

21. I feel this professor would be a popular professor
1 2 3 4 5 6 7

How old do you think this professor was?
21-30 31-40 41-50 51-60 61+

This professor was a:
Male Female

Appendix D

Voice Evaluation

For each of the following rate the voice of the professor using the seven-point scale below.

1	2	3	4	5	6	7
Strongly Disagree	Disagree	Disagree somewhat	Neither Agree or Disagree	Agree somewhat	Agree	Strongly Agree

1. I feel the professor had a high-pitched voice
   1 2 3 4 5 6 7

2. I feel the professor had a low-pitched voice
   1 2 3 4 5 6 7

3. I feel the professor had an appealing voice
   1 2 3 4 5 6 7

4. I feel the professor had a calm voice
   1 2 3 4 5 6 7

5. I feel the professor had a pleasant voice
   1 2 3 4 5 6 7

6. I feel the professor had a persuasive voice
   1 2 3 4 5 6 7

7. I feel the professor had an approachable voice
   1 2 3 4 5 6 7

8. I feel the professor had an attractive voice
   1 2 3 4 5 6 7

9. I feel the professor had an annoying voice
   1 2 3 4 5 6 7

10. I feel the professor had an authoritative voice
    1 2 3 4 5 6 7

11. I feel the professor had a caring voice
    1 2 3 4 5 6 7

12. I feel the professor had a trustworthy voice

1	2	3	4	5	6	7

13. I feel the professor had a meaningful voice

1	2	3	4	5	6	7

14. I feel the professor had a kind voice

1	2	3	4	5	6	7

Appendix E

Script for Presentation- Generalized Anxiety Disorder (GAD)

Hello Everyone

Today we will be going over the topic of Generalized Anxiety Disorder or GAD.

What is Generalized Anxiety disorder? GAD is a psychological disorder marked by excessive anxiety and worry in the absence of specific situations or objects that might be associated with anxiety reactions. Simply put, GAD is a psychological disorder characterized by excessive anxiety and worry when it may not be necessary. GAD is diagnosed when an individual fulfills the diagnostic criteria.

The diagnostic criteria that make up GAD require the following in accordance with the Diagnostic and Statistical Manual of Mental Disorders:

A. Excessive anxiety and worry that occurs more days than not for at least 6 months

B. The individual finds it difficult to control the worry.

C. The anxiety and worry are associated with three or more of the following

1. Restlessness or feeling keyed up or on edge
2. Being easily fatigued
3. Difficulty concentrating or mind going blank
4. Irritability
5. Muscle Tension
6. Sleep disturbance (such as difficulty falling or staying asleep, restlessness, or unsatisfying sleep)

D. The Anxiety, worry, or physical symptoms cause clinically significant distress or impairment in social, occupational, or other important areas of functioning

E. The disturbance is not due to the effects of a substance or other medical condition

And Finally F. It is not better explained by another mental disorder

Alright, that was a lot of information. Let's break it down a little further and look at what we just covered. Essentially, the main component of GAD is excessive anxiety and worry about a number of events or activities. Now, this is not saying it's just anxiety, no, this is saying that the intensity, duration, or frequency of the anxiety is much greater out of proportion to the actual likelihood of the anticipated event. The individual has a hard time controlling their worrisome thoughts and these thoughts or ideations interfere with the individuals everyday life compared to typical worries that are more manageable and may be put off. These worries may be so great that they may be accompanied by physical symptoms like restlessness or that feeling of being on edge.

Other features that accompany GAD may be trembling, twitching, feeling shaky, muscle aches or soreness. Other individuals may experience somatic symptoms such as sweating, headaches or nausea, and an exaggerated startled response. Individuals with GAD do not experience accelerated heart rate, shortness of breath or dizziness as prominently as individuals with other anxiety disorders like panic disorder.

Now that we know more of the criteria let us look at the development and course of GAD. Individuals with GAD report feeling anxious and nervous all of their lives. The median age of onset is 30 years old. There is a very broad range of onset however, it rarely occurs prior to adolescence. Younger adults experience greater severity of

symptoms than older adults. Children and adolescents tend to worry more about school and sporting performance even when their performance is not being evaluated. Children with this disorder may be overly conforming perfectionist, and unsure of themselves and tend to redo tasks because of excessive dissatisfaction with less-than-perfect performance. They often seek and require excessive reassurance and approval. Adults, on the other hand worry more about the well being of family, safety or physical health.

The 12-month prevalence of GAD is .9% among adolescents and 2.9% among adults. Lifetime morbid risk is 9%. Behavioral inhibition, neuroticism, and harm avoidance have been associated with GAD. One-third of the risk of experiencing GAD is genetic, and childhood adversities and parental overprotection have been associated with GAD.

There are slight culture-related variations with GAD. Some cultures may express more somatic symptoms while other cultures express more cognitive symptoms. Those of European decent are more likely to experience GAD than those who are not of European decent. As for gender-related issues, Women are twice as likely to experience GAD than men. In fact, approximately 2/3 of those diagnosed are in fact female. However, similar symptoms are evident in females and males.

Alright let's bring this into real life experiences. Those with GAD may have a difficult time doing everyday tasks quickly and efficiently since much of the worrying takes time and drains the individual of their energy hence the associated symptoms. Because of the difficulty working efficiently, and the time and energy that is devoted to the worrying, the individual may experience impairment at work and home. This

excessive worrying may also impair the individuals ability in encouraging confidence in their own children.

Comorbidity, or likelihood of GAD being diagnosed with some other mental disorder, differs across the genders. Both may experience GAD with some other anxiety disorders, However, females tend to stay confined to the anxiety disorders and depression whereas males tend to extend the comorbidity to substance abuse.

Ok, This brings us to the end of the presentation over Generalized Anxiety Disorder. Please remain in your seats and await further instruction.

Appendix F

Script for Presentation- Standard Deviation (SD)

Hello Everyone

Today we will be going over the topic of standard deviation. What is standard deviation you ask? Standard deviation is the square root of the variance. It can be understood as the typical distance of a randomly selected score from the mean of the distribution. Simply put, it is approximation of how much a score is above or below the average score or mean.

You can see this when you look at a distribution curve. For example, if the data plots are tightly clustered and the distribution curve is steep, then the standard deviation is small. However, when the data plots are spread apart and the distribution curve is relatively flat, the standard deviation is much larger.

So let's take a look at these two data sets. In column A we have the data scores of 5, 5, 4, 4, 3, and 3. In column B we have the data scores of 8, 8, 6, 2, 0, and 0. If we took the data set in column A and added them all together then divide by 6 we would get our average or mean of 4. Likewise if we took our data set in column B and added them all together then divide by 6, we would get an average or mean of 4. So if we were to just look at the mean of each of these data sets, we would think that they are exactly the same because there is no difference between them. However, just by looking at the numbers in the data set we can clearly see that they are different. The numbers in column A are much closer to the mean than the numbers that are in column B. In column A the lowest number is 3 and the highest number is 5 both are really close to the mean of 4. On the

other hand the lowest number in column B is 0 and the highest number is 8, both are much further from the mean of 4. Since the numbers in column B are much further apart than column A we can conclude that the standard deviation in column B is higher than Column A. And in fact, After figuring the standard deviation, you can see that the standard deviation in column B is indeed higher than column A.

So what is the importance of the standard deviation? Well, if the standard deviation is smaller, it reflects more clustered data. More clustered data indicates less extreme values, and less extreme values points to a more reliable mean or average. Therefore, standard deviation is a good measure of the reliability of the mean.

Next, standard deviation allows us as researchers to make more precise statements about the distribution.

Finally, one can use the standard deviation of a sample to estimate the standard deviation or functions of a population.

Now a standard deviation may be helpful and it clearly is different than a simple mean, but how do we obtain it? Obtaining the standard deviation is a multiple step process that is quite easy to do by hand. First, we find the mean of the given set of numbers. Second, we subtract the mean from each number in the data set. Third, we square the sum of each number. Fourth, we add the total of the squares together. The fifth step is dependent on whether you are measuring a sample or a population. If we are measuring a sample we would divide the sum by n-1, if you are measuring the population than we would divide the sum by n. Finally, we find the square root of our answer in step 5. Congratulations, you have just found the standard deviation.

To break this down further, let us look at the formula for standard deviation. Alright, all of these symbols might look confusing but if we break each one down we can understand it. Here we can see that the sigma sign means population standard deviation. The epsilon means the sum of. The x stands for the value in the data set. The x with a line over the top is the mean of all values in the data set, and n is the number of value in the data set. It is also important to note that this is the formula we would use if we were looking for the standard deviation in a population. If we were looking for the standard deviation in a sample than we would replace the n with n-1.

Alright let's get started with an example. Lets say we have the data set of 1, 2, 3, 4, and 5. First thing we will do is find the average or mean of this data set. To do this we will add them all together: so 1 +2+3+4+5 which gives us 15. Now we will take 15 and divide by the total number of the data set which is 5. This will give us the average or mean of 3. For the next step we can create a table that has two columns one with our x value and one with our x value minus the mean than that result squared. So we can see 1-3 is -2, -2 squared is 4. 2-3 is -1, -1 squared is 1. 3-3 is 0 0 squared is 0, 4-3 is 1 1 squared is 1 and 5-3 is 2, 2 squared is 4. Now if we add all of the squared values together we would get 10. Therefore 10 would be the summation of our values of x minus x bar squared.

Now lets review our formulas. Many people get confused on which formula to use. So let's look at our data set 1, 2, 3, 4, 5. If this data set was from a sample of a larger data set than we would use the sample formula on your right. If this data set was the entire population than we would use the population formula on your left.

Now let's tie these numbers into the formula. Again if we are using the population formula we would have sigma or standard deviation equaling the square root of the summation of our values of x minus x bar squared, which we found was 10, divided by the total number of values in this case we had 5. So if we take 10/5 and square root it we would have a standard deviation of 1.41. If we did the same with the sample formula we would divide 10 by 5-1 and square root the answer. This would give us the standard deviation of 1.58.

Ok, This brings us to the end of the presentation over Standard Deviation. Please remain in your seats and await further instruction.

Appendix G

Generalized Anxiety Disorder Quiz

Circle the letter that best answers each question.

1. What is Generalized Anxiety Disorder?

A) A psychological disorder marked by excessive hallucinations
B) A psychological disorder marked by extreme restlessness
C) A psychological disorder marked by excessive anxiety and worry in the presence of specific situations that are associated with anxiety or worry
D) A psychological disorder marked by excessive anxiety and worry in the absence of specific situations that are associated with anxiety or worry

2. Which is NOT a characteristic of Generalized Anxiety Disorder?

A) Restlessness or on edge
B) Delusional thoughts
C) Difficulty concentrating
D) Difficulty controlling worry

3. Which individual shows more diagnostic/associated features of GAD

A) A 13-year-old female who shows no significant distress but has a lot of muscle tension.
B) A 30 year old female who is easily fatigued, irritable, has sleep disturbances and shows significant distress because her worry is out of her control
C) A 13 year old male who is easily fatigued, irritable, has sleep disturbances and shows no significant distress and can control his worrying
D) A 30 year old male who who is easily fatigued, irritable, has sleep disturbances and can not control his worrying

4. An individual must show symptoms that occur more days than not for at least how long?

A) 6 months
B) 1 month
C) 1 year
D) 6 weeks

5. Generalized Anxiety Disorder has higher comorbidity with _____ in females and a higher comorbidity with _____ in males.

A) Obsessive Compulsive Disorder; Depression
B) Depression; Obsessive Compulsive Disorder
C) Substance Abuse; Depression
D) Depression; Substance Abuse

Appendix H

Standard Deviation Quiz

Circle the letter that best answers each question.

1. What is Standard Deviation?
   - **A)** The average (or mean) of the numbers in the data set
   - **B)** The median of the numbers in the data set
   - **C)** An approximation of how much a score is above or below the median
   - **D)** An approximation of how much a score is above or below the mean

2. Which is NOT a characteristic of Standard Deviation?
   - **A)** A good measure of the reliability of the mean
   - **B)** It determines cause and effect
   - **C)** Use SD for a sample to estimate the SD of a population
   - **D)** Allows us to make precise statements about the distribution

3. Identify the formula used to solve for Standard Deviation.

A) $$s_D = \sqrt{\frac{\sum x^2 - \frac{(\sum x)^2}{n}}{n-1}}$$

B) $$s = \sqrt{\frac{\sum(x-\bar{x})^2}{n-1}}$$

C) $$s^2 = \frac{\sum(x-\bar{x})^2}{n-1}$$

D) $$\chi^2 = \sum \frac{(f_o - f_e)^2}{f_e}$$

4. Which data set has the highest standard deviation?
   - **A)** 100, 90, 120, 110, 80
   - **B)** 95, 95, 115, 115, 80
   - **C)** 100, 95, 110, 105, 90
   - **D)** 100, 99, 102, 101, 98

5. What does the following symbol mean?

$$\sum$$

   - **A)** Mean of all values in the data set
   - **B)** Number of value in the data set
   - **C)** Difference of
   - **D)** Sum of

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DATE: April 3, 2018

TO: Thomas Augustin

FROM: Fort Hays State University IRB

STUDY TITLE: [1032129-4] Voice Effects in Video Teaching Methods

IRB REFERENCE #: 17-107

SUBMISSION TYPE: Amendment/Modification

ACTION: APPROVED

APPROVAL DATE: April 3, 2018

EXPIRATION DATE:

REVIEW TYPE: Exempt Review

Thank you for your submission of Amendment/Modification materials for this research study. Fort Hays State University IRB has APPROVED your submission. This approval is based on an appropriate risk/ benefit ratio and a study design wherein the risks have been minimized. All research must be conducted in accordance with this approved submission.

This submission has received Exempt Review based on the applicable federal regulation.

Please remember that informed consent is a process beginning with a description of the study and insurance of participant understanding followed by a signed consent form unless documentation of consent has been waived by the IRB. Informed consent must continue throughout the study via a dialogue between the researcher and research participant. Federal regulations require each participant receive a copy of the signed consent document. The IRB-approved consent document must be used.

Please note that any revision to previously approved materials must be approved by this office prior to initiation. Please use the appropriate revision forms for this procedure.

All SERIOUS and UNEXPECTED adverse events must be reported to this office. Please use the appropriate adverse event forms for this procedure. All FDA and sponsor reporting requirements should also be followed.

Please report all NON-COMPLIANCE issues or COMPLAINTS regarding this study to this office.

Please note that all research records must be retained for a minimum of three years.

Based on the risks, this project requires Continuing Review by this office on an annual basis. Please use the appropriate renewal forms for this procedure.

If you have any questions, please contact Leslie Paige at 785-628-4349 or lpaige@fhsu.edu. Please include your study title and reference number in all correspondence with this office.