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Workplace Bullying: A Qualitative Analysis of Organizational Hierarchy and Conflict-Oriented Rhetoric

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ABSTRACT

While a growing body of literature exists assessing the importance of workplace bullying within an organizational setting, many "black boxes" within this literature stream still remain. Of particular interest to the current work is the impact of different types of rhetoric utilized within an organizational setting and how said rhetoric is able to either exacerbate or mitigate these workplace bullying events. The current research seeks to partially fill this gap by examining the impact of 1) rhetoric used by individuals at different levels of the organizational hierarchy, and 2) rhetoric centered around conflict, specifically cognitive versus affective. By doing so, the current work seeks to provide a more in-depth understanding of how workplace bullying events evolve and thus provide suggestions for how these events may be alleviated, if not eliminated, within the organizational setting. Managerial and organizational implications are discussed.

Keywords: workplace bullying, conflict, organizational hierarchy, management, organizational behavior

Introduction

Workplace bullying is the "repeated, health-harming mistreatment of one or more persons (targets) by one or more perpetrators" (Workplace Bullying Institute, 2014). In order for said behaviors to rise to the level required for legal recourse, the actions must consist of abusive conduct and meet the *reasonable person* standard. Abusive conduct refers to the commission or omission of a behavior that would result in a "reasonable" person to assume that said behavior is abusive (Healthy Workplace Bill, 2014). The typical parameters for meeting the reasonable person standard centers around the severity and frequency of the behavior such that the more severe and/or more frequent the behavior, the more likely it will be construed as abusive. The application of said parameters means that such behavior may include, but is not limited to, verbal abuse, teasing, threatening or intimidating conduct, sabotage, or even malicious gossip.

Workplace bullying may occur in any organization and any industry. The industries most often cited for workplace bullying are nursing, academia, and those industries dominated by one particular sex over another such as the military (e.g. Felbinger, 2008; Hutchinson, Vickers, Jackson, & Wilkes, 2006; Kivimaki, Elovainio, & Vahtera, 2000; Lewis, 1999; Privitera & Campbell, 2009). Workplace bullying has also been shown to influence a myriad of aversive and counterproductive workplace effects including, but not limited to, emotional (e.g. Brousse et al., 2008; Quine, 1999; 2001; Vartia, 2001), physiological (e.g. Brousse et al., 2008; Felbinger, 2008;

Kivimaki et al., 2000; Quine, 2001), psychological (e.g. Hallberg & Strandmark, 2006; Quine, 2001), and organizational (e.g. Lutgen-Sandvik, 2006; Quine, 1999; 2001). Of importance to managers, workplace bullying has been shown to increase absenteeism (e.g. Kivimaki et al., 2000), intent to leave the organization (e.g. Lutgen-Sandvik, 2006; Quine, 2001), critical nature of the organizational climate of trust (e.g. Quine, 2001), and levels of felt anxiety and depression (e.g. Quine, 2001), while decreasing job satisfaction (e.g. Quine, 2001). Furthermore, workplace bullying has also been shown to influence body mass of individuals exposed to said events (e.g. Kivimaki et al., 2000) and the need for medical treatment (e.g. Hallberg & Strandmark, 2006). The pervasive nature of these effects can range from the short-term, i.e. dissipating after a year ((i.e. Brousse et al., 2008) to long-term, i.e. never going away as the bullied individual feels marked for life (i.e. Hallberg & Strandmark, 2006). Of even greater importance to management is the finding that these detrimental effects are not experienced by just the targets of workplace bullying but also by individuals that observe these events. Vartia (2000) found that both the target(s) of workplace bullying, but also the observer(s), experienced an increase in mental and general stress as a result of the workplace bullying event.

Another important literature stream that the current work seeks to build upon focuses on the impact of managerial narrative (i.e. rhetoric) during organizational events. Scholars have found that managers use narrative and symbolic materials to change meaning systems within the organization (e.g. Fiol, 2002; Giola & Chittipeddi, 1991). The concept of shifting meanings by managerial narrative has been supported (e.g. Barry & Elmes, 1997; Brown, 1998) and typically focuses on creating meanings that are novel in comparison to current organizational stories. The utilization of said narrative allows organizational members to provide structure to organizational events (e.g. Pentland, 1999) in order to capture how events are related to other events over time (e.g. Gergen& Gergen, 1997) and within specific contexts (e.g. Gergen, Gergen, & Barrett, 2004). Sonenshein (2010) found that managers used two main narratives: 1) transformational, and 2) preservational in which the former focuses on shifting meanings and the latter focuses on solidifying meanings within the organizational context. This research, while not mutually exhaustive, does help elucidate the importance of narrative during important organizational events such as workplace bullying.

Following a three-year, in depth, intensive case analysis in which the author was an observer of an ongoing workplace bullying event, the current work seeks to explain the importance of rhetoric within an organizational setting on the impact of workplace bullying events. Specifically, the current work will focus on two important components of rhetoric: 1) the position of the individual in the hierarchy using said rhetoric, and 2) the level of inherent conflict embedded within the rhetoric, i.e. affective versus cognitive conflict-oriented rhetoric. Thus, this work will identify important situations that may become exacerbated by the words organizations' members are using and, as a result, perpetuate the workplace bullying event. Furthermore, this work will also propose practical solutions for how management and other organizational members may properly address said workplace bullying events without perpetuating or exacerbating the negative effects of said events.

Purpose of the Current Work

A review of the literature has found no focus on the impact of the terminology utilized during a workplace bullying event on the perpetuation or discontinuation of said workplace bullying event. This gap in the literature provides a fruitful situation for scholarship to attempt to understand how the words utilized by organizational members during a workplace bullying event may either exacerbate or mitigate said events.

The current work seeks to help elucidate this issue by explaining the effect of rhetroric-oriented antecedents on the pervasiveness that workplace bullying has on an organization. Of particular interest, the current work focuses on the influence of rhetoric within the organization and how it can serve productive or counterproductive means. Specifically, this paper assesses how rhetoric by different organizational members (all exposed to a workplace bullying event) within academia can impede or exacerbate the prevalence of workplace bullying. As such, the current work utilizes qualitative findings from a two-study format to assess how conflict-oriented rhetoric (Study 1) and position (i.e. thus assessing the organizational hierarchy) of the individual engaging in the rhetoric (Study 2) to measure the impact on a continuing workplace bullying event. Specifically, Study 1 assesses the impact of affective versus cognitive conflict, as exemplified by the rhetoric used during the workplace bullying event. Study 2 assesses the impact of rhetoric used by specific and various members within an academic setting during a workplace bullying event: target, bully, direct supervisor, middle management, upper management, and "third" parties (i.e. HR, Equity & Diversity).

Methodology

Study 1

The following information presented stems from a three+ year long, ongoing, workplace bullying event in which the lead author was an observer. The workplace bullying event occurred at a small to medium-sized university in the United States that primarily focuses on undergraduate and graduate instruction. As such, the primary focus of the university is on teaching as opposed to research. The analysis includes interviews, observations, emails, and testimonials that were analyzed by the lead author to identify any common trends in the rhetoric used by individuals involved in the workplace bullying event. This analysis is focused primarily on what is being said as opposed to who is saying it.

Study 2

The information presented is also a result of the exposure of the lead author in the same workplace bullying event as described in Study 1. The analysis includes interviews, observations, emails, and testimonials that were analyzed by the lead author to identify any common trends in the rhetoric used by individuals at different levels of the academic hierarchy and the resulting impact of said rhetoric on either the perpetuation or mitigation of the workplace bullying event. As such, this analysis focuses much more on who is speaking as opposed to what is being spoken.

Results

Study 1

Analysis of the interviews, observations, email analysis, and testimonials revealed that the rhetoric used by individuals within the workplace bullying event focused around either affective or cognitive conflict-oriented rhetoric. Affective conflict (often dubbed emotional conflict) occurs when individuals disagree over personal and/or emotionally charged issues whereas cognitive conflict (often called task conflict) is a disagreement between individuals centered on preferences or opinions about how a task should be performed (Mooney, Holahan, Amason, 2007). The former reduces the likelihood of productive decision making occurring because it distracts individuals from focusing on the task at hand (Jehn, 1994; 1995; Simons & Peterson, 2000) as it blurs objectivity based on the heightened level of emotions involved. On the other hand, the latter can facilitate higher quality decision making because it aids teams in accommodating and "blending" multiple points of view (Schweiger, Sandberg, & Rechner, 1989) into one viewpoint that the individuals can "own" together.

Affective Conflict Examples. Example number 1 occurred early during the workplace bullying event during a public meeting in which one of the individuals alleged to be a bully began to speak about the personal and/or lifestyle choices of the target(s) in an attempt to get the target(s) fired. In one specific meeting of supervisors, one individual (Bully 1) was quoted comparing the target to another "famous" individual (i.e. well-known, public figure, nationwide) in an attempt to evoke visceral and negative emotional reactions from other supervisors who had the power to terminate the target. When others began to rebuke the comparison by pointing out inconsistencies, Bully 1 increased the commitment to the rhetoric and attempted to "sell it" more so to the other supervisors.

During an interview with one of the supervisors present, the supervisor (Supervisor 1) noted that it was obvious that Bully 1 was not making sound and rational judgments because "emotion had gotten the better of his/her judgment." Supervisor 1 followed this statement by conjecturing that the target(s) would be wise to avoid Bully 1, to the extent avoidance is possible, in an attempt to avoid providing "ammo" for Bully 1.

Example 2 occurred during a separate public event of outside/external advisors to the college in which the target worked. In this instance, an individual who had been involved in bullying the target (Bully 2) asked multiple members of the external board to intervene in the termination of the target. The logic behind such a request, purported by Bully 2, was that the supervisors who had the power had "failed to do their jobs" and thus the external board must place pressure on the supervisors to "do the right thing."

During an interview with Supervisor 1 and multiple witnesses to the event, a consistent analysis of the situation was that Bully 2 was erratic in behavior, acting in a manner that seemed inconsistent with someone thinking soundly and acting in a controlled manner. In fact, one person named Witness 1, said that this person clearly was behaving in an emotionally unstable manner to the point that others at the event began to avoid Bully 2. Consistent with example 1, Bully 2 was unable to make sound, rational, and logic decisions based on his/her emotions blurring the

situation. Furthermore, despite multiple supervisors acting in a consistent manner of not taking action against the target, Bully 2 began to believe this non-action meant that a dereliction of duty or collaboration on the part of the target and supervisors was transpiring (as opposed to accepting that the target had not done anything wrong).

Example 3 occurred during another public event in which Bully 2 began to verbally attack a "friend" of the target thus making this friend (dubbed Target 1) a non-victim target. Bully 2 derided the individual, calling names, yelling, insulting, calling Target 1's decision making into question, all in an attempt to (*seemingly*) get a reaction from either Target 1 or the Victim.

After speaking with Supervisor 1, the supervisor concurred with the assumption of the lead author that Bully 2 seemingly was attempting to provoke a reaction that would support Bully 2's assertions about the victim thus justifying punishment of the individual. Supervisor 1 also added that Bully 2 did not seem to care that any reaction by the victim, or even Target 1, likely would have been justified as Bully 2 had instigated the situation.

With all three of the scenarios listed, the emotions of the bully became so intense that the ability of the bully to engage in objective and rational decision making was blurred. After speaking with multiple supervisors and the victim of the bullying event, this type of rhetoric only intensified the perceptions of the victim and others that the bullying was getting worse as opposed to "dying down."

Cognitive Conflict Examples. Another type of rhetoric that became prevalent during the workplace bullying event was the utilization of sound and rational thought on the part of multiple individuals (Bully 3 and Bully 4) in attempt to use data to cause the victim to be punished (i.e. terminated).

Example 1 of cognitive conflict occurred toward the beginning of the bullying event when Bully 3 approached Supervisor 1 about a claim that the victim was derelict in his/her duties as a teacher. Bully 3 cited a story from a student and observations of classroom lights being off. This incident led Bully 3 to assert the conclusion that the victim was not doing his/her job and thus needed to be terminated. While speaking with Supervisor 1, the lead author found that Bully 3 was "simply taking things at face value and skewing data in an attempt to promote a specific message." In other words, Bully 3 was interpreting the data in a manner that would support Bully 3's attempts to get the victim fired. Supervisor 1 explained that upon speaking with the victim of the bullying event, each and every concern was easily and justifiably explained (in the supervisor's opinion). Supervisor 1 also noted that it was shocking that highly educated individuals, trained in research, did not utilize their training when bringing accusations against another. Supervisor 1 noted that this situation could have easily been explained by Bully 3 speaking with the victim to address any concerns.

Example 2 occurred when Bully 3 and Bully 4 approached Supervisor 1 in an office setting in an attempt to bring another accusation against the target that would justify termination. Bully 3 and Bully 4 noted that a student had come forward claiming a "personal" relationship between another student and the faculty member was occurring. According to Bully 3 and Bully 4 this relationship was deemed highly unethical and inappropriate and thus required immediate action.

During an interview with Supervisor 1, he/she explained to the lead author that, once again, had the individuals "engaged in any actual research of the situation instead of believing every single instance that supported the punishment of the victim that they wanted," both Bully 3 and Bully 4 would have found "holes" in the stories. Specifically, the student making the accusation had been turned down by the victim (i.e. the student asked the faculty member to go out on a date and the faculty member said no), the student discovered that Bully 3 and Bully 4 had a "mission to terminate" the target (i.e. during public comments about not liking the victim, the student overheard and took the cause to Bully 3), and that the faculty handbook did not "outlaw" any such relationship between a faculty member and a student (i.e. the relationship, provided both individuals are adults, would have ***NOT*** been considered "illegal").

The theme that became clear during these examples was that while Bully 3 and Bully 4 were focused on valid concerns with the victim (i.e. they perceived an issue with performance of the job and reputation of the organization), this logic and rationale fell short of the rigor one would expect from faculty at a university. Instead, the scrutiny one would engage in during research stopped short of disconfirming the preconceived notion the individuals had about the victim.

Subsequent analysis. Further analysis for any other trends in the rhetoric used during the workplace bullying event showed that the rhetoric was also divided by whether the individuals admitted (openly or privately) to using said rhetoric to intentionally or unintentionally make the situation worse ***and/or*** if the targets of the bullying felt the rhetoric was perceived as being intentional or unintentional.

In each of the examples discussed previously, the intentionality versus unintentionality of the rhetoric had a profound impact on the perception of the event. In fact, while speaking with the victim of the bullying events, when intentionality was perceived (i.e. Example 2 of the affective conflict section) to be high, felt emotions by the victim became more intense as "the hurt experienced by the victim became more intense." On the other hand, if the individual felt that the intentionality of the action was also "masked" by more objective concerns (i.e. example 1 of cognitive conflict) the level of hurt (and anxiety felt) by the victim was not as intense.

Discussion

The current work has provided a small percentage of the bullying events observed in an attempt to begin to paint a picture of the importance of how affective-versus cognitive-oriented rhetoric can influence a workplace bullying event. The focus of the analysis for this study centered around the words being used in an attempt to analyze the importance of what is being said. In the next study reported, the analysis switches to focus on "who" is engaged in the workplace bullying event by analyzing his/her position within the organizational hierarchy and how that position influences perceptions of the workplace bullying event.

Study 2

Analysis of over 100 hours of interviews, observations, testimonials, and emails (analysis of obtained emails) revealed two overarching themes: 1) hierarchical position of individuals within a workplace bullying event had "common" and consistent response mechanisms to the workplace bullying, and 2) the rhetoric being used conformed to an inclusive-versus exclusive-oriented rhetoric in an attempt to "seemingly" support one's case. As such, the following section will report these findings with examples to better explain this phenomenon.

Organizational Hierarchy. Results suggest that those individuals directly above the victim according to the organizational hierarchy (i.e. whether by formal position or rank via promotion), at least in this academic setting, either were combative and/or noncommittal whereas individuals at the same level as the victim were either supportive or noncommittal. Furthermore, administration (those at least two levels higher than the victim) were mainly noncommittal (likely in an attempt to avoid taking sides or opening the organization to legal culpability) and thus seemed to utilize a belief system that the behavior would "just stop." The three main themes of behavior observed were 1) supportive, 2) combative, and 3) noncommittal. Supportive behavior was typified by individuals within the workplace bullying setting who were willing to "stand-up" against the perpetrators (both bullies and non-bully perpetrators [see Author, 2017 for a complete discussion]). For example, one such individual had frequent verbal altercations with at least one of the bullies in an effort to tell the bullies to "back off." In fact, at one point, this supporter suggested the bullies "focus on doing their jobs and leave others alone who were doing their jobs already." Combative behavior was typified, typically, by individuals either that were bullies or non-bully perpetrators (specifically, those who seek to instigate). These individuals were willing to go to any lengths to see the victim punished including but not limited to climbing the "organizational ladder" in an attempt to find someone who would agree with the bullies' assessment. For example, one of the bullies spoke with a department chair, two deans, a provost, chancellor, external advisory board, and legal for the university all in an effort to get the victim fired. The noncommittal behavior was typified by responses of "not my problem," "I don't care," and/or "I don't want to be involved in this issue." Hierarchically, individuals on the same level as the bullies were more likely to respond with "I don't care" or "This isn't my problem" whereas individuals who were on the same level as the victim (and thus suspecting they also could become targets) were more likely to respond with "I don't want to be involved in this issue" as they were concerned with reprisal.

Subsequent analysis. After reflecting upon these three behavioral responses, another trend became obvious to the lead author that seemingly exacerbated the situation: the omission versus commission of behavior. While commission of a behavior is the actual performance of an action, omission is the withholding of an action, and in this instance can be just as serious and facilitate a workplace bullying event as much, if not more, than the actual commission by the bullies. For example, during a peer review of the victim, multiple individuals had the opportunity to ask for proof of accusations on the part of the bullies about the victim. However, instead of asking for proof (something academics should be used to doing), they accepted the claims and were willing to "write-up" a negative review on the word of a colleague, thus perpetuating the bullying behavior as the bully(ies) were not "called" on his/her(their) actions. In fact, in multiple instances, the bullies engaged in slanderous and libel behavior and no one was willing to "push" against the bully(ies). Despite the fact that all individuals were on the same organizational level (i.e. tenured and

promoted) and thus could suffer no real reprisal, these individuals refused to act in a way that would impede the bullying and thus resulted in exacerbating (through the rewarding of bad behavior) the bullying event. Another act of omission observed was the omission of any proof of accusations on the part of the bully(ies). After speaking with an independent, third party investigator brought into the case, the investigator stated, "these individuals felt they could say anything they wanted without providing any support for such claims, which omits the need for burden of proof." While the investigator was not strictly speaking from a legal means, the investigator did highlight a second instance of the omission of behavior. In fact, during interviews with the bullies, the investigator reported comments such as "well, I don't have any proof, but…" or "I believe" or "I don't have to prove my case, the target must prove I am wrong." All of these examples are instances that show that the bully(ies) felt they could omit actually proving their claims and expected action to be taken based on their words.

Inclusive versus Exclusive Rhetoric. Another theme that became apparent upon reviewing all of the interviews, emails, and materials was a distinct difference in terminological used by individuals who were against the victim versus those in either support of, or those who were neutral. Although assessing rhetoric was not the focus of this current analysis, as Study 2 sought to focus on more contextual factors, this analysis would not be complete without reporting these findings. Inclusive terminology such as *we, our, ours, us* embolden the reader/listener to feel that people are on the same level and thus in this issue together. Examples included, but are not limited to the following: "We will make it through this problem," "It is our responsibility to solve this problem together," "We all share in the burden of resolving this issue," and "We must be patient as we seek to resolve this issue." All four examples exemplify a rhetoric seeking to evoke feelings of togetherness and reassure the victim that he/she is not alone. Furthermore, all four examples were generated from administrators in low to middle level positions who seemed genuinely concerned about the situation and willing to try to help. Exclusive terminology such as *I, you, your, yours, me,* and *my* evoke emotions and feelings of being alone in a situation. In fact, when asking the victim how it felt to be exposed to such words, it was described as being in "solitary confinement", "adrift on a ship without a crew", or "being on a deserted island without Wilson" (a reference to the Tom Hanks movie, *Castaway*). Examples of exclusive rhetoric included, but are not limited to the following: "I feel that you need to be open-minded to the issue (a comment from an administrator seeking to stop the complaint from going to the next level), "I am unwilling to discuss this matter with you (a comment from an administrator who did not want to be involved with the situation)," and "If you take legal recourse, you will be fired (a comment mentioned by a top-level administrator in response to the query by the victim as to whether the victim should seek legal guidance)."

General Discussion

Study 1

From a practitioners' standpoint, the current work suggests that words truly do matter. Study 1 showed that the rhetoric utilized by organizational members, specifically when centered around the context of affective versus cognitive conflict, had significant impacts on the perceptions of workplace bullying events. While most research focuses on more "substantial" antecedents and

mitigating factors of workplace bullying, this analysis suggests the very cheap, quick, and simple words that emanate from one's mouth may have significant impact. In fact, in Ephesians 4:29 of the King James Version Bible says, "Let no corrupt communication proceed out of your mouth, but that which is good to the use of edifying, that it may minister grace unto the hearers." This verse represents a concept organizational members should focus on more before acting/speaking by asking themselves the question, "What good will this do?" The idea is that if something being said/done will not add value or help the situation then the statement/action probably does not need to be stated/done. Furthermore, Proverbs 15:1 states, "A soft answer turneth away wrath: but grievous words stir up anger," thus suggesting that the only purpose of some rhetoric such as affective conflict-oriented rhetoric is to exacerbate the situation. As such, managers need to train themselves and all organizational members on the effective and efficient ways of communicating by engaging in intellectual discourse in which differences of opinions may be stated but respected. In other words, you do not have to like the person or what he/she says but you should respect his/her right to believe a certain way and to voice his/her opinion.

Theoretically, this analysis suggests the importance of rhetoric on important organizational events such as workplace bullying. It emphasizes the need to further study rhetoric such as inclusive versus exclusive (see Study 2) and the intentional versus unintentional nature of the rhetoric being utilized (see Study 2). Future research should focus on other important rhetoric or terminology. Future research should also focus on the specific position of individuals and how that position moderates and/or mediates perceptions of the rhetoric being used. In other words, if a bully who is at the same level of an organization as the victim utilizes affective conflict-oriented rhetoric, would this be perceived significantly differently if mid-level management, top-level management, or even an owner/ceo used the same rhetoric? Finally, other contextual variables should be assessed, such as the location of the events, timing (both day of week, time of day, but also following meetings, before meetings, during meetings, etc.).

Study 2

In a continuation of Study 1, Study 2 sought to further analyze important contextual factors with a specific focus on the wording/rhetoric used at different organizational levels and how that relationship of key variables impacted workplace rhetoric. What the analysis demonstrated was a significant influence on perceptions of the event and a significant difference in the types of rhetoric used at the different levels. First and foremost, the nature of the rhetoric was different from one level of the hierarchy to the next. Specifically, this analysis showed that the rhetoric centered around three differing behavioral types: 1) supportive, 2) combative, and 3) noncommittal. Subsequent analysis of the situations also identified that the omission versus commission of rhetoric by important organizational members also had a significant impact on the perceived outcomes of the workplace bullying events. Finally, the inclusive versus exclusive terminology used seemingly alleviated versus exacerbated perceptions of workplace bullying. In the Book of James, Chapter 3, verse 8 of the King James Version of the Bible the statement is made, "But the tongue can no man tame; it is an unruly evil, full of deadly poison." While this particular scripture is not arguing intentionality of the words, the thought is consistent with the findings in this analysis. The words used during important organizational events, such as workplace bullying, while often discounted and assumed to be insignificant, do in fact have a significant impact on how these organizational events "play out." Research has shown that being the subject of workplace bullying

can lead to victims experiencing psychological effects (e.g. lack of focus, depression, dissatisfaction), physiological effects (e.g. stress and coronary issues), performance effects (e.g. performance dips/drops), and organizational effects (e.g. higher attrition). In the context of the current study, this information suggests that the words organizational members use can be very costly to organizations and their members.

This analysis also suggested that *telling* becomes *showing* when behavior is reinforced by the omission of a punishment for individuals who are perpetuating workplace bullying (or any organizational deviant behavior). Furthermore, when individuals are allowed to refer to noncommittal emails or dialogue from organizational management, this act also reinforces the behavior of the bully(ies) as they do not perceive any real punishment for their behavior and/or they assume a lack of punishment may mean they are perfectly within their means/rights to behave in such a manner.

Finally, this analysis suggests the importance of sensing shifting paradigms within the organizational context. Rhetoric is likely to change as individuals within the workplace bullying event (i.e. witnesses and/or management) begin to change their opinions of the ethical and/or just nature of the behavior. Specifically, one would expect to a see a shift in rhetoric to be more supportive/noncommittal as opposed to combative or just noncommittal, and more inclusive as opposed to exclusive in nature. Individuals must remember that the initial gut reaction by management will always be to reject that such an event is happening inside of the workplace (as is human tendency, i.e. this [*insert negative event*] will never happen to me or this will never happen where I live/work fallacy) and thus will only be willing to accept that workplace bullying exists and is taking place once it is proven beyond the normal and expected means. Once workplace bullying has been proven, the shift in acceptance is slow, as the organization will want to make sure it does not assume any legal culpability.

Future research should analyze how the wording in organizational policies and public statements are able to influence workplace bullying events. Furthermore, how does the punishment (i.e. if it is given, frequency, and intensity/magnitude) chosen against a bully or bullies impact the workplace bullying culture within the organization. Future research needs to focus on further exploration of this important topic as there is still much to understand about this "elementary" behavior within the organization. This work sought to help elucidate practitioners and scholars on the very important component of rhetoric and perceptions of workplace bullying. The current work hopefully will serve as a springboard for future research.

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The Chilly Climate Gets Warmer: Perceptions of Classroom Experience in a Newly Coeducational College

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ABSTRACT

Women's colleges have decreased by more than 80% over the past 50 years, with 230 colleges in the 1960s and about 36 today (Women's College Coalition, 2019). The current study examines how young women perceive the classroom environment during the transition year in a small liberal arts college moving from single sex to coeducational. Researchers hypothesized that today's young women would be less vulnerable to the negative effects of coeducational classrooms that have been well documented in the literature on chilly climate (Hall & Sandler, 1982, 1984; Sandler & Hall, 1986). Ninety-nine undergraduate students completed a questionnaire designed to assess students' perceptions of comfort when participating in coeducational classes as well as the BEM Sex Role Inventory (Bem,1974). Results indicated that 72% of our sample reported feeling just as comfortable participating in coeducational classrooms, as they were in single-sex classrooms. The results of this study can be viewed through an optimistic lens and perhaps be attributed to the awareness and attention given to issues of "chilly climate" and gender inequity in the past several decades. While the findings in this study were hopeful, the researchers point to the need for college faculty and staff to encourage young women to transfer confidence and assertiveness skills from the classroom to the workplace.

Keywords: gender, chilly climate, classroom participation, women's college, coeducational classroom

Introduction

According to the Women's College Coalition (2019), the number of women's colleges have decreased more than 80% over the past 50 years and as of fall, 2019 there were only 36 active women's colleges in the United States. Given this shift toward a national norm of coeducational higher education, it is important to understand how women in these newly co-educational colleges feel in their new environment. For many, these single-sex colleges represented an opportunity for young women to develop self-confidence and adopt leadership roles in a supportive, all-female environment.

Very often the decision to move to a coeducational institution is a financial one, based on decreasing enrollment trends. While the financial bottom line does improved by these changes, how are the female students affected? Has their classroom changed to a chilly climate now that their classmates are both men and women?

What we have learned from decades of research on the chilly climate is that the factors which contribute to the environment often occur in subtle and unnoticed ways. In fact, these factors often remain out of conscious awareness and are therefore, difficult to address. There is a particular concern about the prevalence of "microinequities," a term originated by Mary Rowe of MIT to describe "apparently small events which are often ephemeral and hard-to-prove, events which are covert, often unintentional, frequently unrecognized by the perpetrator, which occur wherever people are perceived to be different." In her 1972 work exploring underrepresented individuals at MIT, Rowe spoke to the "cumulative, corrosive effect" that these "little issues" have over time. Sandler (2005) points out that while there has been a reduction in the most blatant forms of sexism in the classroom, there are subtle ways women are treated differently and over time these microinequities take a toll on women.

Over the years the topic of single-sex education, especially for women, has been explored. This has been an important area of research looking at both K-12 education and higher education. A 2017 article, "Can Women's Colleges Attract Women? Can Ex-Women's Colleges Attract Men" states that while the elite Seven Sisters Institutions are doing well, many smaller women's colleges are struggling to stay open due to low enrollment (Inside Higher Ed). The article also describes the alumni backlash that many of these institutions face with the decision to admit men. Without these institutions, many worry that today's young women will never have the opportunity to experience the benefits of a women's college. The question that has emerged is whether there is still a need for these environments, particularly for today's young women who have been raised in a culture that has been strongly influenced by decades of the women's rights movement.

Historically, there has been concern about academic institutions having a "chilly climate." The construct, developed by Hal and Sandler (Hall & Sandler, 1982, 1984; Sandler & Hall, 1986) describes how female and male faculty treat men and women differently in the classroom and create an educational environment that discourages female participation, devalues women, and ultimately lowers their educational confidence, and self-esteem. The construct has also been applied to female faculty in academic institutions and researched in STEM (science, technology, engineering, math) environments where women are significantly underrepresented. Morris (2003) reviews the literature on this topic and points to conflicting evidence on whether the "chilly climate" exists, both in and outside of the classroom. In her review, Morris cites empirical evidence with support for both sides of the argument. Less research exists on whether this environment is still in existence for young women of the millennial generation (born between 1983-2000). This question is particularly relevant in a society where women's colleges are essentially disappearing and the long-term effects of these closures are yet to be determined.

Many factors impact classroom participation including gender of the student and professor, balance of gender in the classroom, and academic disciplines. A study by Crombie, Pyke, Silverthorn, Jones, and Piccinin (2003), explored multiple contextual factors when examining perception of classroom participation in 541 undergraduate students. In addition to student gender,

the researchers looked at class size, gender balance in class composition, discipline, gender of the instructor and particular instructor behaviors, student age, perceived level of participation, and perception of specific student behaviors. The researchers found partial support for the chilly climate model. Male students rated their participation as higher than females from the same classes and active males perceived themselves as participating more and interrupting more than female students who perceived themselves as active.

Morris and Daniel (2008) examined perception of a chilly climate between students majoring in traditionally female dominated majors versus male dominated majors. The researchers administered the Perceived Chilly Climate Scale (PCCS) to students in nursing and education (female) and information technology and engineering (male). Results indicated that students in the traditionally female dominated majors perceived the environments to be chillier than students in traditionally male dominated majors.

A study by Salter and Persaud (2003) examined classroom climate in 142 undergraduate females majoring in either education or engineering. Using a Jungian framework, the researchers looked at the Thinking-Feeling dimension on the MBTI in order to explore the fit of learning style and classroom participation and chilly classroom phenomenon. They looked at Thinking vs. Feeling oriented classrooms in terms of encouraging or discouraging participation. The researchers found that feeling-oriented classes seemed to be a better fit for female students and to encourage more female participation. Most importantly, they found that instructors played a crucial role in creating a positive classroom environment for women.

One area that goes beyond the scope of this study, but is nevertheless important to address is the fact that women in STEM are greatly underrepresented in academia. With regard to choice of major, there is a body of literature addressing women's underrepresentation in STEM majors. In particular, many have studied the environments of STEM classroom climate. Simon, Wagner, and Killion (2016) looked at masculine and feminine personality characteristics in STEM majors and ultimately careers. They found that masculine personality characteristics are not especially rewarded in STEM majors, but there was a cost for women in STEM who possessed feminine characteristics. While this larger issue is beyond the scope of the current study, it is important to explore classroom environments for women in STEM majors following a transition to a coeducational institution.

The current study focuses on undergraduate women's perceptions of the climate in a coeducational classroom during the transition year of moving from a women's liberal arts college to a coeducational liberal arts college. This is an exploratory study to explore initial effects.Therefore, this study was designed with an intentionally narrow focus to capture the immediate reaction to the transition. It is important to continue exploring the impact this transition has for young women as the institution moves toward having a more equitable gender distribution.

Based on classroom discussions with college-aged women, who reported confidence in classroom participation in previous single-sex settings, the researchers were curious about how comfort levels in classroom participation might change during a transition period from single-sex to coeducational. Specifically, the researchers hypothesized:

1. College-age women in a newly coeducational school will report rarely feeling discomfort when participating in coeducational classes.
2. College-age women will be more likely to participate in a class where they feel it is equally likely for men and women to be called on by the professor.
3. Character traits of masculinity and femininity will influence the perception of comfort in a coeducational setting.

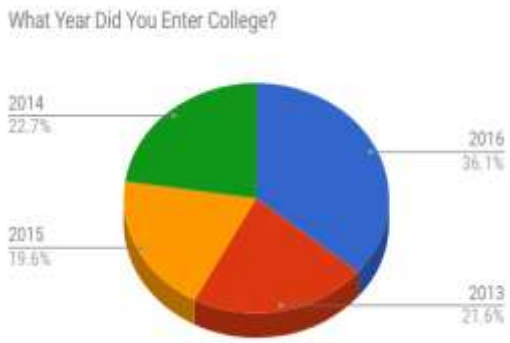
Method

Participants

Ninety-nine undergraduate students between the ages of 18-25 were recruited via email at a private, liberal arts college in the northeastern United States. The college serves approximately 2000 students in graduate and undergraduate programs. For the purposes of this study, only undergraduate students were sampled. The college was chosen because it was undergoing a transition from a women's college to a coeducational college the year data-collection was scheduled. Thus, a quasi-experimental design was created using first year freshman who were entering a coeducational college as the control group, and the sophomore, junior, and senior students as the experimental group. The experimental group had between one and three years in a single-sex women's college and were expereincing a coeducational college setting for the first time. Thirty-six percent of the sample were first year students who had entered the college during its transitional year.

Respondents reported diverse ethnicities, 35% African Diaspora/African American/Black, 26% Latin@, 27% White/Caucasian, 2% Asian, 1% Other, 6% No response, 1% Native American, 2% Multi-racial, and 1% Bi-racial. However, 90% of participants were female. Ninety percent of the participants attended a coeducational high-school prior to entering college. Sixty-four percent of respondents entered the college when it was a women's college, while 36% of the respondents entered during the coeducational transition year (Figure 1). Therefore, despite only 64% of our sample entering a women's college prior to the coeducational transition, the vast majority of our sample had experienced a coeducational environment in high-school.

Figure 1.



Materials and Procedure

Participants were sent a weblink to the anonymous online Survey Monkey questionnaire. No IP addresses or identifying details were collected. The online questionnaire was comprised of a fifteen-item questionnaire that was designed to assess students' perceptions of comfort when participating in coeducational classes. The four questions used to directly assess comfort in coeducational classes were: 1) I feel less likely to participate in co-ed classes, 2) I feel more nervous asking a question in a co-ed class, 3) I feel more nervous answering a question in a co-ed class, and 4) I think one gender gets called on more frequently by my professors at this college. These questions were reverse coded on a 7-point likert scale with 1=always or almost always and 7=never or almost never.

In addition to the 15 item questionnaire, participants completed the BEM Sex Role Inventory (Bem, 1974). Participants self-report how much they identify with each of 60 character traits are rated by participants on a scale of 1-7, with 1= never or almost never applies to me and 7= always or almost always applies to me. The character traits are divided into three categories: feminine, masculine, and androgynous. Despite the fact that the validity of the BSRI has been contested over the years, (Hoffman & Borders, 2001), it met the needs of this study by providing a well researched set of character traits that map on to gender identity that is non-binary. The purpose of adding this measure was to explore whether self-reported character traits of masculinity and femininity influenced comfort in a coeducational setting differently than binary gender identities of male and female.

Results

An average comfort score was calculated for each participant using the 3 comfort questions: *I feel less likely to participate in co-ed classes, I feel more nervous asking a question in a co-ed class, I feel more nervous answering a question in a co-ed class,* where a 1= always or almost always uncomfortable in a coeducational setting and 7=never or almost never uncomfortable in coeducational classes. The resulting average *Comfort* score gave us an overall measure for how each participant felt participating in coed classes. The overall *Comfort* score demonstrated that 55% of our sample reported feeling generally comfortable participating in coed classes. In addition, 72% of our sample are just as likely to participate in a coed class as a single-sex class. Only 5.4% of our sample reported feeling like they were less likely to participate in co-educational classes. We interpreted these findings as supportive of the hypothesis that our female students reported rarely feeling discomfort when participating in coeducational classes.

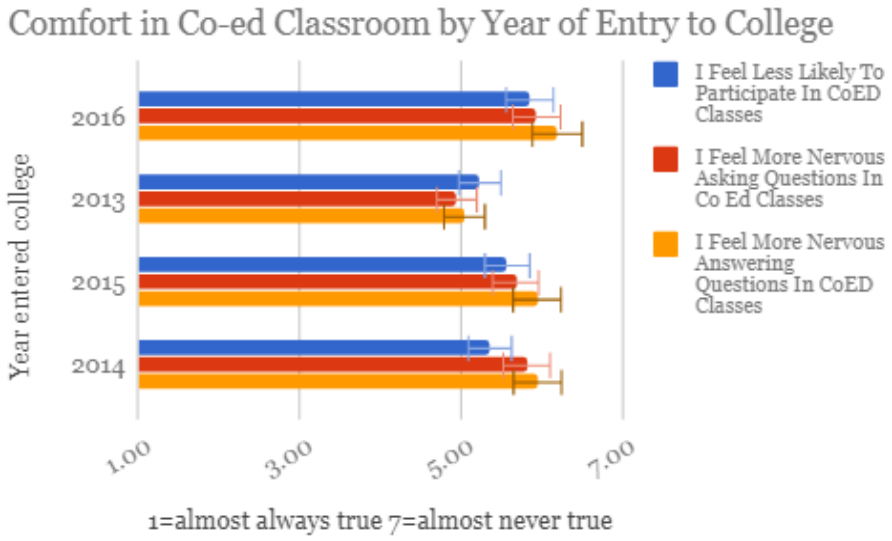
To test whether there was a relationship between students' perception of faculty calling on one gender more than another and the students' reported comfort level of students we ran a Pearson Correlation. We found a moderate positive correlation between whether or not a participant perceived *one gender was called on more than the other* and their *level of reported comfort in participating in co-educational classes*, r_s=.428, p<0.01.

To explore if women who reported more masculine character traits felt more comfortable in a co-educational setting than women who reported feminine character traits we calculated three scores for each participant: a masculinity score, a femininity score, and an androgyny score. Once each participant was scored, they were placed into a single category based on which scale they scored the highest. Using the median-split method, (Hoffman & Borders, 2001), participants were assigned to either masculine, feminine, or androgynous. If their score on the masculine subscale was above the median, they were categorized as *masculine*, if their score on the feminine subscale was above the median, they were categorized as *feminine*, and if both scores were either below or above the median, they were categorized as *androgynous*. We thought this might be a more nuanced way to look at gender roles in the classroom than traditional binary gender identity. We then used the BSRI categories as the independent variable with three levels (*masculine*, *feminine*, and *androgynous*) to compare participants' comfort in coeducational classrooms. We conducted an ANOVA looking at the effect of Self Identified Character Traits on comfort with participation in coed classes. We found no difference between students who reported more feminine traits, more masculine traits, and more androgynous traits.

There was some speculation that self-identified ethnicity might play a role in the level of comfort reported by participants. There were no significant differences between the different ethnicities in how comfortable they reported feeling when participating in co-educational classes, general class participation, or their perception of one gender being called on more than the other gender.

Further ancillary analysis revealed a weak but significant negative correlation between the year a student entered the college and feelings of discomfort in a co-educational classroom, *I feel more nervous asking a question in a coed class* r_s=-0.234, p<0.05, *I feel more nervous answering a question in a coed class* r_s=-0.295, p<0.05, *I feel less likely to participate in coed classes* r_s=-0.222, p<0.05. These results suggest that while a majority of students reported feeling comfortable participating in college classes, those students who entered the college when it was co-ed generally felt more comfortable in co-ed classrooms than students who began at the school when it was a women's college (Figure 2).

Figure 2.



Discussion, Limitations, Further Study

Our findings suggest some support for the first hypothesis; female students reported feeling equally comfortable in coeducational classrooms as they were in single-sex classrooms. We also found support for the idea that there is a relationship between a student's perception that one gender was called on more than the other and their level of reported comfort in participating in coeducational classes. The more frequently a student feels both genders are equally called on in a class, the more comfortable they feel participating in the class. While we hypothesized that more masculine traits might be related to more comfort participating in classes, we found no difference between students who reported more feminine traits, more masculine traits, and more androgynous traits.

As ancillary analysis indicated, students who entered the school when it was still a women's college reported less comfort participating in coeducational classes than students who entered the school during the transition year. This result may point to the fact that those students who chose to enter the college during the transition year did so knowing that they were choosing a coeducational school, while students entering prior to the transition had purposely chosen a women's college. However, despite the lower levels of reported comfort in coeducational classes, overall rates of comfort with class participation was high, indicating that the majority of students do feel comfortable participating in their classes, regardless of when they entered.

The results of this study can be viewed through an optimistic lens and perhaps be attributed to the awareness and attention given to issues of "chilly climate" and gender inequity in the past several decades. The work of many individuals, such as Bernice Sandler, seems to have brought crucial awareness to these issues and perhaps positively influenced classroom climates in academic institutions encouraging young women to possess strong voices, even in coeducational settings.

There are many limitations to the current study. The classroom gender balance was still heavily weighted in the direction of women. While men were in attendance, the majority of classes were still female. It is possible that if the gender balance were more equitable, women would have felt differently about their classroom experiences. Further research should be conducted in classrooms that have a more equitable gender balance or where women are underrepresented in the classroom, in particular, women in STEM majors.

While the current sample size is small, 99 participants represent approximately one third of the college's undergraduate student body. While the sample is likely a good representation of this college, it is not necessarily representative of other colleges who have undergone the transition from single sex to coeducational. In addition, 90% of our sample attended a coeducational high school and were perhaps entering the institution with an inherent degree of comfort in coeducational settings. However, it is important to distinguish high school and college settings. While intimidation and feelings of academic inferiority happen in every educational setting, it is safe to say that the status of college can intensify these feelings for many. So even if a young woman was comfortable in a coeducational high school, that comfort may not translate to a college classroom.

Another limitation was that students were reporting perceptions, and not faculty behaviors. Assessing behaviors would have been important given what we know about

microinequities often being outside the awareness of both faculty and students. Finally, academic major and faculty gender and age were not assessed.

While the findings in this study were hopeful, it's important to remember that much more needs to be done in terms of gender equality. If in fact, classroom environments are becoming more supportive of women's voices, the question remains why women are still subject to so many inequities in society, in particular, in the workplace. The Bureau of Labor Statistics "Highlights of Women's Earnings in 2015" reports that women who were working full-time were paid 80 percent of what men were paid. "The Simple Truth About the Gender Pay Gap" (AAUW, Spring 2017 edition) states that if the rate of change in the pay gap continues at the rate is has been since 2001, it will be 2152 before women's pay is equitable with men's pay. The pay gap exists at every level of academic achievement, and in fact, the gender gap is sometimes larger in those with advanced academic degrees.

If today's young women are feeling more empowered in the classroom, how do we help them bring those skills to life outside of the classroom? More attention needs to focus on empowering women to feel assertive in situations following graduation, particularly entrance to the workforce. If we are noticing that women feel less intimidated in a coeducational classroom, it's imperative that we think about what's next and encourage faculty to find ways to help young women bring that confidence to life beyond the classroom.

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Children's Behavior Problems and Parental Mental Health Issues: Practice and Research Implications

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ABSTRACT

This study is based on a review of the literature investigating the relationship between children's behavior problems and parental mental health issues. The study has three purposes: 1-review the literature on the relationship between children's behavior problems and parental mental health issues; 2-identify factors associated with mental health issues among parents whose children exhibit behavior problems; 3- design a theoretical framework. A review of relevant literature dealing with parental mental health issues and children's behavior problems was conducted on MEDLINE, Alt HealthWatch, Health Source, ERIC, Psychology and Behavioral Sciences Collections, PubMed, ProQuest, and Sociological Abstracts. Research evidence suggests that three sets of factors are associated with mental health issues of parents who are dealing with children's behavior problems: parents' characteristics, children's characteristics, and mediating factors. The authors developed a theoretical framework that captures the connections among these sets of factors and discussed implications for practice, research, and future studies.

Keywords: parents, mental health, mental illness, children's behavior problems, qualitative approach

Introduction

The causes of mental health among parents are complex and multifactorial (Bessa, 2012a; Bessa, Eldemire, & Pleth-Suka, 2015; Bessa, Brown, & Hicks, 2013). However, the analysis of relevant literature has found several major factors such as child characteristics, mediating factors, and parental characteristics that are associated with mental health issues of parents who are dealing with their children's behavior problems. The present study is based on a review of relevant literature conducted on several databases such as MEDLINE, Alt HealthWatch, Health Source, ERIC, Psychology and Behavioral Sciences Collections, PubMed, ProQuest, and Sociological Abstracts using the following phrases: 1) parental mental health issues and children's behavior problems; 2) parents' mental illness and children's antisocial behaviors; and 3) parents' stress and children's challenging behaviors.

The purposes of the study are threefold: 1) review the literature on the relationship between children's behavior problems and parental mental health issues, 2) identify factors associated with mental health issues among parents whose children exhibit behavior problems, and 3) design of theoretical model and potential policies which will help reduce mental health issues among parents who are dealing with behavior problems of their children.

This article is subdivided into four major parts. The first part focuses on the literature dealing with parents' characteristics affecting parental mental health issues. The second part deals with literature investigating the influence of child characteristics on parental mental health issues. The third part presents the analysis of mediating factors affecting the relation between parental mental health issues and children's behavior problems. The fourth part contains the synthesis of the first three parts in the form of a theoretical model and the study implications.

Clarification of Concepts: parental mental health issues and children's behavior problems

While most studies on the topic have drawn similar conclusions as to the relationship between children's behavior problems and parental mental illness, they have differed in terms of their conceptualization of the children's behavior problems (Baker, Blacher, Crnic, & Edelbrock, 2002; Baker et al., 2003; Bessa, 2012b; Fidler, Hodapp, & Dykens, 2000; Greenbaum & Auerbach, 1998; Hauser-Cram, Warfield, Shonkoff, & Krauss, 2000; Stores, Stores, Fellows, & Buckley, 1998). Within the context of this paper, the concept of children's behavior problems refers to externalized and internalized behaviors such as emotional reactions, depression/anxiety, withdrawal, somatic, sleep problems, delinquency, attention, aggression (Baker et al., 2003), irritability, lethargy, hyperactivity (Store et al., 1998), defiance (Mash & Johnson, 1990), deviance, conduct disorder (Lang, Pelham, Atkeson, & Murphy, 1999; Pelham & Lang, 2000) restless, inattention, impulsivity, and noncompliance (Fischer, 1990).

As with the case of children's behavior problems, researchers have conceptualized parental mental health issues in various ways. However, the concept of parental mental health issues will be used interchangeably with parental mental problems, parental mental illness (Bessa et al., 2015; Duchovic, Gerkensmeyer, & Wu, 2009), including depression and stress (Baker, Blacher, Crnic, & Edelbrock, 2002; Baker et al., 2003; Fidler, Hodapp, & Dykens, 2000; Hauser-Cram, Warfield, Shonkoff, & Krauss, 2000).

Factors of Parental Mental Health Issues Associated with Children's Behavior Problems

Parents' Characteristics

Gender. One important characteristic of parents that affects parental mental health issues is gender. Many studies have focused more on mothers than on fathers (Baker et al., 2003; Fischer, 1990; Haskett, Ahern, Ward, & Allaire, 2006). According to Haskett and colleagues (2006), the heavy focus on mothers can be attributed to two major factors. First, most single parents are mothers, meaning that mothers are more likely to be dealing with child behaviors than fathers. Second, in most societies, mothers do more in the socialization process of a child, even in two-parent families (Bessa, 2012b; Haskett et al., 2006).

In general, most studies on parental mental health issues and children's behavior problems have reported higher rates of stress among mothers than fathers (Aneshensel, Frerichs, & Clark, 1981; Bird & Rieker, 1999; Campell, Converse, & Rogers, 1976; Essex et al., 1999; Glenn & McLanahan, 1981; Hastings, 2003; Moes, Koegle, Schreibman, & Loos, 1992). For Essex et al. (1999) and Hastings (2003) the differential rate of stress among parents is linked to the fact that mothers are more heavily involved in everyday activities than are fathers and are consequently more exposed to the challenging behaviors of the child. It follows that mothers are more affected by those behaviors (Sloper, Knussen, Turner, & Cunningham, 1991) and as a result are more likely to have higher levels of depression than fathers.

Four general theoretical perspectives have been offered to explain the differential levels of stress among parents of both genders (Bessa, 2012b). First, according to gender-biased perspectives, the discrepancy is due to differences between women and men or mothers and fathers in seeking help and reporting symptoms (Bekker, 1996; Kessler, 1979; Kessler, Brown, & Broman, 1981; Piccinelli & Simon, 1997; Piccinelli & Wilkinson, 2000; Silverstein, 1999; Wilhelm & Parker, 1994). Second, the gendered-response theory shares some points in common with the first but is diametrically opposed to it in terms of its conclusion. This theory postulates the existence of gender differences in the expression of stress. Being socialized to express their emotions, women are not only willing to report but also more likely to seek help when experiencing mental health issues, compared to male their counterparts (Tausig, Michello, & Subedi, 2004). The third perspective applies factors such as socioeconomic status (SES) and social roles to account for the differences in stress levels (Bebbington, 1996, 1998; Bekker, 1996; Bird & Rieker, 1999; Kornstein, 1997; Mirowsky & Ross, 2003; Piccinelli & Wilkinson, 2000; Tausig et al., 2004). To avoid redundancy, the paper will later discuss in some detail in the section title titled "Socioeconomic status" the role of SES and social roles play in the differential levels of mental health problems among genders (fathers and mothers).

The fourth perspective, related to the third, is built around the dominance-dependence argument, and shares some similarities with conflict theory. According to this theory, the position of dominance of fathers at a societal as well as familial level can explain the gender differences in depression. For example, the position of the head of the household often occupied by fathers gives them power, control, and dominance over mothers. That is mothers, for the most part, are not only subjugated but also subordinated and dependent of fathers. This dominance-dependence relationship is consequential for the depression levels of both fathers and mothers, as the former are more likely to dominate and more importantly to vent frustrations toward the latter (Horwitz, 2002).

In opposition to studies reporting differential levels of depression among mothers and fathers are those supporting the argument of no difference (Heller, Hsieh, & Rowitz, 1997; Rousey, Best, & Blacher, 1992; Sloper, Knussen, Turner, & Cunningham, 1991; Trute, 1995). Pelham and colleagues (1997) too reached the conclusion of no difference in the level of distress between mothers and fathers in their research investigating the association between deviant child behavior, paternal distress, and alcohol consumption. For them as many other researchers supporting the no difference argument, the differential levels in stress between mothers and fathers reported by other studies is socially constructed. That is, the difference can be linked to the formulation of the

interview questions, or in the conceptualization and operationalization of key concepts (Hubbard, 1990; Umberson & Williams, 1999).

Age. Unlike gender, age, has not been well documented in the literature. There is inconsistency in the literature with regard to the effect of parents' age on their mental health. Most past studies either have shown that age of parents has no significant influence on their mental health levels (Duchovic et al., 2009; Klose& Jacobi, 2004) or have simply ignored it (Helbig, Lampert, Klose, & Jacobi, 2006; Lang, Pelham, Atkeson, & Murphy, 1999; Pelham & Lang, 2000). However, there is evidence arising from community surveys suggesting an age effect (Horwitz, 2002; Mirowsky & Ross, 2003).

The importance of age in mental health problems was also shown in a study conducted by Glidden and Schoolcraft (2003) on depression among mothers of children with intellectual disabilities. The authors found that older mothers are less likely to be depressed compared to younger ones. One possible explanation of this difference in depression by age can be found in adaptational theory. The main assumption of this theory is that, as years pass, mothers or parents become accustomed to their children's behavior problems and consequently adjust more easily to them (Heller et al., 1997; Townsend, Noelker, Deimling, & Bass, 1989). Apart from this process of acclimatization, this theory also stresses the notion of maturity. As parents age, they mature, accumulate a great deal of experience and, as a result, are better equipped to effectively cope with the behavior problems of their children. Opposed to the adaptational theory explanation is the "Wear and Tear" theory, which postulates that parental stress levels increase over time. The main argument of this theory is that the adverse effects of the challenging behavior problems of the children wear parents down over time (Birenbaum, 1971; Johnson & Catalano, 1983).

Race. As with age, discussions of the effect of parents' race on their mental health levels related to children's behavior problems are scarce in the literature (Bessa, 2012b). However, the few studies which have examined the influence of race on parental mental health have a tendency to confirm to a general pattern found in mental health studies whereby racial-ethnic minority groups are more at risk than the majority group (Mirowsky & Ross, 2003). This vulnerability of racial-ethnic minority groups to mental health problems has be linked to their disadvantaged conditions. Black parents, for example, are more likely to be less educated as compared to white parents (Evenson & Simon, 2005). Being less educated, black parents are limited to certain types of jobs, such as menial or unskilled work. The effects of such jobs include low incomes which can lead to living in poor neighborhoods (Caughy, Nettles, & O'Campo, 2008; Elliott, 2000; Xue, Leventhal, Brooks-Gunn, & Earls, 2005). The confounded influence of all these unfortunate conditions frequently increases parents' distress levels (Pinderhughes, Bates, Dodge, Pettit, & Zelli, 2000).

Socioeconomic status. Another factor influencing parental mental health is the socioeconomic status (SES) of parents (Emerson, 2003; Hastings, 2002; Horwitz, 2002; Mirowsky & Ross, 2003; Simon, 2000). In most social research, SES is defined in terms of education, income, employment, and/or types of work. Using the components education and income, Breslau, Staruch, and Mortimer (1982), in their study on psychological stress among mothers, found that the depression level of mothers decreases with an increase in income and education levels. Mirowsky and Ross (2003) explained this negative relationship between parental mental health levels and SES using the concepts of power and control. A higher level of education gives parents a sense of power.

The knowledge accumulated through education gives parents the feeling of being masters of their lives. As the level of education increases, the attendant higher income gives parents a feeling of power and being in control, which helps them adjust to distress. As high SES is associated with low distress levels, the inverse relationship also holds. That is, parents with low SES experience higher stress levels (Hudson, 2005). This inverse relationship explains why parents from certain social groups are more vulnerable than others.

The link between being in a minority and vulnerability to stress can be explained through education, which is found to be the most influential component of SES (Bessa, 2012b; Mirowsky & Ross, 2003). One of the merits of education is to give individuals the ability to think in order to solve problems. Thus, parents from majority racial-ethnic groups, who are more likely to have higher levels of education, are better equipped to deal with mental health problems than their minority racial-ethnic group counterparts to think through problems caused by the behavior problems of their children and find ways to deal with them (Dix, 1991; McLoyd, 1990). This aptitude for thinking when faced with problems gives parents a sense of power which ultimately leads to self-esteem, self-worth, and thus to good mental health (Horwitz, 2002; Schlosser, 1990). Another no less important impact of a higher level of education is related to its attendant phenomenon, higher income. As parents from the majority racial-ethnic groups are more likely to have higher education, their income is also likely to be higher. Higher income has been shown to be associated with lower mental health problems (Aneshensel & Sukoff, 1996; Ross, Reynolds, & Geis, 2000). No wonder parents from minority racial-ethnic groups have tended to report more stress than parents from the majority (McLoyd, 1990; Myers & King, 1983). Black parents, for instance, experience higher levels of mental health problems as compared to their white counterparts (Pinderhughes et al., 2000).

Education can also explain differences between fathers' and mothers' stress levels. Given their social context, fathers are more likely to have a higher level of education than mothers. As a result, fathers are also more likely to have better employment as compared to mothers and can explain in part why they report less stress than mothers.

The impact of paid vs. unpaid work not only explains part of the differential levels of stress between fathers and mothers, but also affects depression levels among mothers. Even though mothers as a group report more distress than fathers, those with paid work experience fewer mental health problems compared to those who have unpaid work or who are housewives (Helbig et al., 2006).

The difference between paid work and unpaid work is not the only characteristic of employment that determines differential levels of distress. Whether work is full-time or part-time also influences stress levels among parents. Full-time employment is associated with less distress than part-time (Kessler & McRae, 1982; Kessler, Turner, & House, 1989). The beneficial effect of full-time employment is not exclusive to the American population only; it has been found in other societies as well. For example, Helbig and colleagues (2006), reached a similar conclusion using a representative sample of the German population. They emphasized the mental health advantages of parents working full-time compared to those working part-time or being unemployed.
Even though most studies investigating the effects of employment on parental mental health have demonstrated the benefits attached to employment compared to unemployment, the literature

review presents some inconsistency when it comes to full-time vs. part-time work. Klose and Jacobi (2004) have shown that full-time work is not always synonymous with low risk of stress for all parents. In fact, they argued that only fathers with full-time employment reported lower levels of stress. For mothers, on the other hand, full-time employment was associated with a higher risk of depression (Brown & Bifulco, 1990; Klose & Jacobi, 2004). Another study which has questioned the impact of SES on parental stress is one by Olsson and Hwang (2001). In their study of parents of children with intellectual disabilities, Olsson and Hwang evaluated parental depression levels in Sweden and compared the results to findings in other countries such as the United States and the United Kingdom. They found that even though parents in Sweden did not report economic strain, they were almost as depressed as parents in the other two countries. Such a finding indicates that the protective effect associated with higher income or wealth should be reevaluated. That is, higher income does not necessarily always constitute a buffer against parental mental health problems.

Religion. While the literature is quite scarce on several factors related to parental mental health issues associated with children's behavior problems, none but one of the past studies has examined the impact of religion (Bessa, 2012b; Bessa et al., 2015). This omission is quite surprising given that religion often involves intense emotion, which is of major interest in the field of mental illness and/or mental health (Roberts, 2004). Conversely to the literature on the current topic, studies on caregiving and/or coping have underlined the importance of religion as a coping mechanism (Bessa, Moore, & Foster, 2012; Schwab, 1990). Religious service attendance is negatively correlated to parental distress. That is, one average, distress level of parents decreases when parents attend one or more religious services (Bessa, 2012b; Bessa et al, 2015). Moreover, studies on classical sociology offer examples documenting the influence of religion on individuals' behaviors (Ritzer & Stepnisky, 2010; Roberts, 2004; Yinger, 1970).

Marital relations. The effect of parents' marital status on their mental health related to parenting is also not well-documented in the literature. Findings in community surveys have indicated that parents who are married have a lesser risk of mental health problems as compared to single parents (Mirowsky & Ross, 2003). The absence of the immediate social support in addition to the economic hardship stemming from lower education levels and unemployment explain the high vulnerability of single parents to mental health problems as compared to married parents (Helbig et al., 2006; Umberson & Williams, 1999). The elevated risk of mental health problems of single parents accounts for their unhealthy lifestyle behaviors, including smoking and alcohol abuse (Baker & North, 1999; Pelham et al., 1997; Shouls, Whitehead, Burstrom, & Diderichsen, 1999).

Not all the studies have consensus toward an association between marital status and mental health levels among parents. Umberson and Williams (1999) argued that some of these findings supporting the existence of correlation between the two variables might be the result of a miscategorization and miscomparison. They pointed out that sometimes studies compare married parents with unmarried parents, a category which includes divorced, separated, widowed, or never married parents. This problematic categorization of both concepts (married and unmarried), can mislead to the difference found between single parents' and married parents' mental health levels (Evenson & Simon, 2005).

Children's Characteristics

Gender. Parental mental health problems are affected by the gender of a child. Studies which controlled for the gender of the child, had overwhelming indications that parents are more distressed with boys than girls (Bessa, 2012b; Crnic & Greenberg, 1990; Turner & Sloper, 1996). Emerson (2003) has shown, for instance, that maternal distress levels vary with the child's gender. Stores and colleagues (1998) have reported similar findings pointing out that, as compared to girls, boys exhibit more behavior problems, which is a contributing factor of their mothers' high depression levels.

This association between parental mental health problems and a child's gender seems to be a cross-cultural phenomenon. In fact, Molteno, Finchilescu, and Dawes (2001) found the same results when studying children and their parents in South Africa. The consistency in the results of cross-national studies has led some researchers to the conclusion that boys are more likely to increase their parents' mental health problems. This conclusion likely explains why some studies have focused on boys only when investigating parental mental health issues (Lang et al., 1999; Pelham et al., 1997).

Age. There is evidence in the literature suggesting that the age of the child influences the parents' mental health. In general, studies have concluded that parents' mental health problems decrease as the age of their child increases (Stores et al., 1998). In other words, having younger children with behavior problems is associated with increased mental health problems in parents than having older children (Hastings, 2002; Umberson & Williams, 1999). Some studies have investigated this correlation further in detail by categorizing ages of children into groups, such as below 9 years, between 9 and 13 years, and 13 and over (Einfeld & Tongue, 1996). Molteno et al. (2001) also applied that idea but with different cut-off points. In their case, they used only two categories, children below 14 and above 14. Working with these categories, they reported that parents of children above 14 years of age showed lower levels of stress compared to those whose children were younger than 14. However, one of the problems with these studies is that they did not provide a rationale for adopting the categories of group age used in their analyses.

The correlation between the age of a child and parental mental health issues can be explained through the concept of developmental stages. Using this theory, Crnic and Acevedo (1995) showed the adverse impacts of the inattentive, overactive, and defiant behavior of the "terrible twos" have on their parents. Fortunately, most children abandon these challenging behaviors as they age (Mills & Rubin, 1990). As children age and become more independent in terms of doing things for themselves, such as going to the toilet, feeding themselves, or cleaning up their own messes, parents perceive and report fewer mental health problems (Kandel, Davies, & Raveis, 1985; Umberson & Gove, 1989). Mash and Johnston (1983), too corroborated the negative correlation between the age of the child and the mental health issues of parents. They argued that behavior problems of younger children are associated with higher depression levels in mothers. They clarified their finding by specifying that mothers of younger children (around 5 years) reported more depression than those of older children (around 8 years of age). Conversely to all the above studies suggesting that parental mental health levels vary according the age of the child, the one by Helbig et al. (2006) found evidence to the contrary. Helbig et al. posited child's age has a negligible effect on parental levels of stress.

Mediating Factors

Parents' coping. When experiencing stressful events, people develop or activate their coping mechanisms (George, 1980; Turner, 1999; Turner, Wheaton, & Lloyd, 1995). Coping mechanisms refer to a repertoire of personal options individuals have to help prevent, avoid, or control distress (Wiess & Lonnquist, 2009). The individual's coping is affected by his or her levels of self-esteem. Self-esteem refers to the idea that individuals have concerning their self-worth, which has been shown to be related to stress (Kendler, Gardner, & Prescott, 1998; Lazarus & Folkman, 1984; Mirowsky & Ross, 2003; Mash & Johnston, 1983; Pearlin et al., 1981; Pearlin, 1999; Rosenfield, 1999; Weiss & Lonnquist, 2009). As in the case of control, high self-esteem or positive self-esteem is associated with less maternal distress whereas low self-esteem or negative self-esteem is correlated to a higher level of distress among mothers living with delinquent children (Bessa et al., 2015).

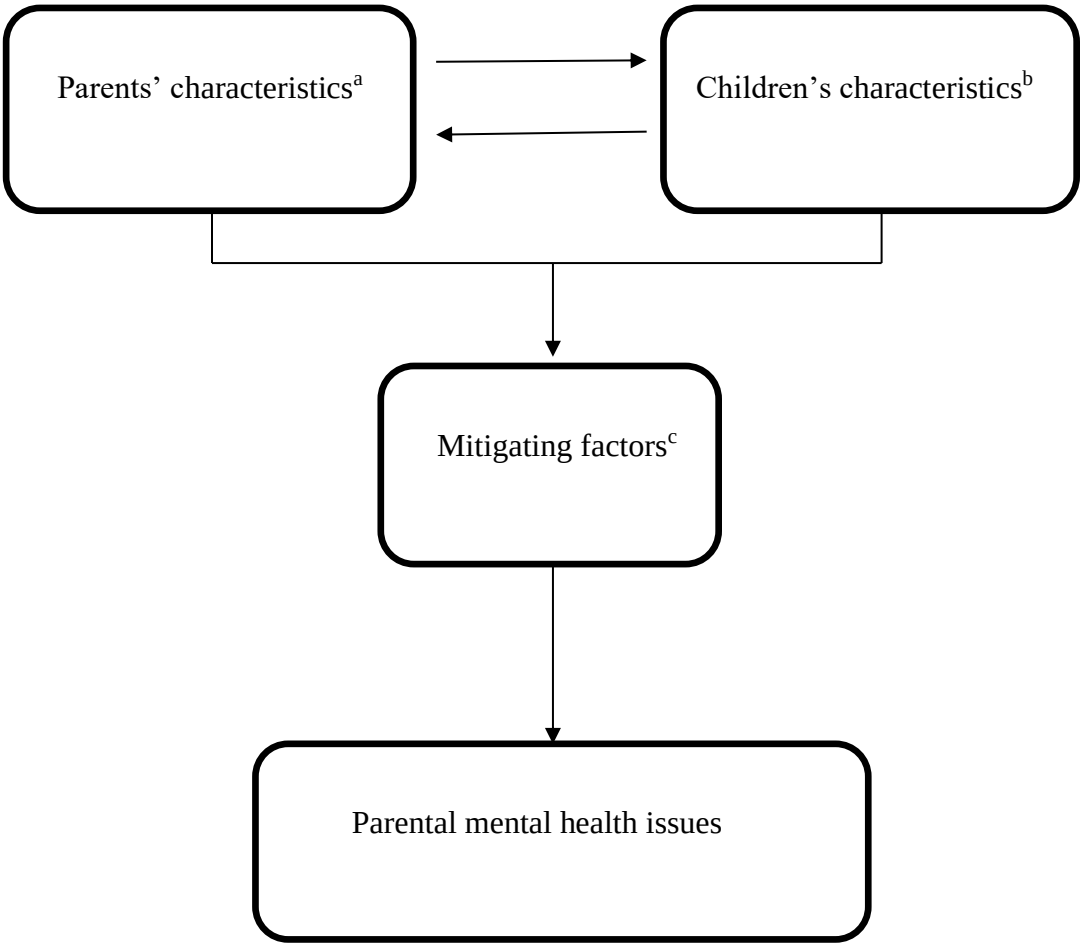
Parents' support system. In addition to these coping mechanisms, parents can draw on social support when experiencing stress (Bessa, 2012b). While a coping mechanism constitutes personal attempts, support systems are social resources from the individuals' network on which they can rely on in time of stress (Pearlin & Aneshensel, 1986). Often, individuals call upon their support systems only in a case where their own coping strategies have failed to effectively fight the stressful situation. Duchovic et al. (2009) conceived two types of social support: tangible and intangible. Tangible support includes respite, loans, gifts, and information. Intangible support refers to emotional support and empathy. Working from these conceptualizations of social support, Duchovic et al. (2009) found that parental support systems did not help them in mediating or moderating the effects of distress associated with their children's behavior problems. However, they cautioned against this result being taken to indicate there being no influence of social support on maternal distress with reference to the small number of parents who reported on their support system.

In any case, this finding of Duchovic et al. (2009) is in sharp contrast with the general pattern of studies on social support. Frequently, most studies documenting the influence of social support on parental mental health have concluded to the existence of a correlation between the two variables. For example, Hastings (2003) found a slight difference between the stress levels of mothers and fathers which was linked to social support. Looking at the stress levels among parents of children with behavior problems, Hastings noticed that mothers' stress, even though higher, is unusually close to the levels of fathers' stress. This closeness of the level of the stress mothers to the one of fathers, according to Hastings, is the result of the supporting role that grandparents might have played in assisting mothers. One conclusion of this study is that social support is important and can make a difference in dealing with stressful situations. The study by Pelham et al. (1997) also depicted the crucial effect of social support on distress by showing the cost associated with its insufficiency or absence. As an example, it has been shown that single mothers have elevated distress levels as indicated by their increased alcohol consumption because they are less likely to have adequate social support systems (Pinderhughes et al., 2000).

Theoretical Framework

The articles reviewed in this study suggests that three sets of factors (child characteristics, parents' characteristics, and mitigating factors) are associated with mental health issues of parents who are dealing with children with behavior problems. Some of the reviewed articles found a link between children's characteristics and parental mental health issues, while others indicated the existence of correlation between parents' own characteristics and their mental health problems. Other still identified the influence of mitigating factors on parental mental health. The analysis of the combined findings of all the articles reviewed in the current paper suggests that the three sets of factors of mental health issues of parents with children exhibiting behavior problems can be linked together (Figure 1). More specifically, the reviewed articles indicated that parents' characteristics and children's characteristics are interrelated, and both variables affect the mitigating factors, which in turn influence parental mental health problems (Bessa et al., 2015; Heaven et al., 2003). That is, the mitigating factors (parents' coping mechanisms) modulate the effects of parents' characteristics and children's characteristics on parental mental health issues.

Figure 1. Theoretical model showing the relationship between the factors of mental health of parents who are dealing children's behavior problems.



[a] Gender, age, race, socioeconomic status, religion, and marital relations.

[b] Gender and age.
[c] parents' coping and support system.

Practice and Research Implications

Practice Implications

The review of the literature on the mental health of parents who are dealing with children's behavior problems leads to practice implications. The findings of this paper lead to two possible intervention plans–two different trainings–to solve parental mental health issues. The first type of training will target future and new parents. During this training, practitioners should provide relatively comprehensive information and tips to future and new parents regarding techniques for caring effectively for their children. This training will be helpful against parental mental health problems associated with the frustration stemming from the confusion and conflicting information regarding the appropriate parenting techniques.

In addition to appropriate parenting caregiving activities, parents should be trained to identify and handle children's behavior problems. The goals of this second type of training are twofold: 1) to teach parents effective ways to handle children's behavior problems. 2) to provide an opportunity for parents to interact with each other and share their challenges as well as their success stories.

Research Implications

The literature indicates three main problems with past studies. First, the analysis of the literature reveals some understudied factors related to parental mental health associated with their children's behavior problems such as age, race, religion, and marital status. Second, the majority of the studies reviewed is based on quantitative methods. Third, the literature has also revealed that almost all the studies on the topic have been conducted in the area of mental disability. Consequently, additional studies are needed to untangle the influence of children's behavior problems on parental mental health. Future studies should address the problems identified in the current paper.

Conclusion

The purpose of this paper is to review relevant literature on the factors of mental health issues of parents who are dealing with children's behavior problems. The analysis of the literature suggests that three set of factors are associated with parental mental health issues. The first set of factors is related to the characteristics of parents (gender, age, race, socioeconomic status, religion, and marital relations). The second set deals with the characteristics of children (gender and age). The third set includes the mediating factors (coping and support system of parents). The paper, ultimately, leads to the identification of risk and protective factors of mental health of parents who are dealing with children's problem behavior. Aggravating factors of mental health among parents are being young, mothers, single, having low SES, low social support, and dealing with a boy or a younger child. Examples of protective factors include high SES, high social support, and being a

mature parent. Knowing these risk factors will help design effective intervention programs and avoid the pitfalls of a one-size-fits-all approach to the problems of mental health among parents.

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Professional Challenges Faced by Female Engineer Executives in STEM Fields: A Critical Look from the Inside

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ABSTRACT

The percentage of women entering the workforce reached a peak during the early 1970s, yet there are still so few women who pursue college majors or careers in science, technology, engineering, and mathematics (STEM). Experts believe lower percentages of women participating in STEM fields can deteriorate the country's ability to compete globally. Moreover, a report by UNESCO states it would behoove U.S. industry leaders to cultivate a pipeline comprised of women trained in STEM. It is common knowledge, innovation and ingenuity drive business and enterprise. This paper reports the findings of a study conducted to explore professional challenges faced by female engineer executives in STEM fields. A descriptive qualitative methodology using a phenomenological lens was used. Purposive sampling with extensive criteria for inclusion, exclusion, and maximum variation was applied. Twelve female executives between the ages of 44 to 66 who held a minimum bachelor's degree in engineering (of whom one holds a degree in geology), built careers in the oil and gas industry, and held positions of vice-president or above were interviewed. Strict protocols were used in sample selections, in the development of interview questions, and coding and analysis of the data. The results of the analysis are reported followed by implications of the findings and recommendations for future research.

Keywords: STEM, female engineer, gender bias, barriers, equity, oil and gas industry

Background

When women began entering the workforce in high numbers during the 1970s, they had to struggle with issues of job segregation and pay inequity (Corbitt & Hill, 2015). Having been traditionally employed as secretaries, social workers, teachers, and nurses these female-dominated fields prompted lower paying salaries due to historical gender bias (Hegewisch & Hartmann, 2014a). Conversely, women's male counterparts have occupied positions and served in capacities as construction workers, engineers, scientists, researchers, physicians, and lawyers, to name some (Hegewisch & Hartmann, 2014a). Although there have been strides made by women in non-traditional fields such as science and technology, a steady upward trajectory has yet to be realized (Woetzel et al., 2015). Furthermore, talent development practitioners are witnessing a decline in females pursuing science, technology, engineering, and mathematics (STEM) fields (Woetzel et

al., 2015). Correspondingly, females in STEM professions are leaving this sector due to feelings of isolation, lack of a perceived viable career path, and few role models or internal sponsors of whom to call upon (Woetzel et al., 2015).

Advocates who foster and promote the advancement of women in STEM professions, enforce workplace policies via legislation (Saavedra & Opfer, 2012). This shift in public opinion regarding women and STEM has resulted due to the dynamics of the global economy and the desire for the U.S. to maintain a competitive edge (Saavedra & Opfer, 2012). Moreover, learning technologies and STEM-centric curricula funded by the federal government and philanthropic entities, such as the Bill and Melinda Gates Foundation, have been instrumental in creating a sense of urgency in facilitating learning and igniting the imaginations of females toward STEM (The New York Academy of Sciences, 2017).

Additionally, the National Science Foundations has carved a major footprint in funding and supporting initiatives that emphasize cultivating female and minority youth regarding the benefits of a STEM profession (Land, 2013). In that vein, this paper will explore determinant factors that led to the success of female engineer executives in addition to the statement of the problem which is also provided in chapter one. Professional teacher development and its impact on student learning outcomes are highlighted in chapter two. Moreover, the review of the literature shows the influence of early exposure to STEM and 21st-century learning. This paper culminates with the performance of American students on the TIMSS exam followed by the benefits of project-based learning to enhance performance.

Notwithstanding, each of these components is fundamental in addressing the findings of a study conducted to explore challenges faced by female engineer executives in STEM fields. A descriptive qualitative methodology using a phenomenological lens was used. Purposive sampling with extensive criteria for inclusion, exclusion, and maximum variation was applied. Twelve female executives between the ages of 44 to 66 who earned at least a bachelor's degree in engineering (of whom one holds a degree in geology), built careers in the oil and gas industry and held a position of vice-president or above were interviewed. Strict protocols were used in sample selections, in the development of interview questions, and coding and analysis of the data. Specifically, the question sought to identify, "What strategies did successful female engineer executives in the oil and gas industry apply to overcome challenges they faced in their career trajectory?" (Houston, 2019). Furthermore, this paper will highlight Bandura's Self-Efficacy Theory that informed the study relating to the competencies, skills, and self-efficacy exhibited by the respective female engineer executive volunteers. Finally, the paper will conclude by offering insights into the findings of the study and recommendations for future research.

Chapter 1: Introduction

America stands at the intersection of the fourth industrial revolution that is essentially shifting how we live, work, and interface (Schwab, 2016). In its scope and breadth, this transformation will scale unlike anything known to humankind (Schwab, 2016). As such, educators, policymakers, industry leaders, and philanthropists alike are faced with the daunting challenge of preparing its citizenry to tackle these technological revelations and assume jobs that have yet to be realized

(Schwab, 2016). In the shadows of these challenges, U.S. leaders are entrusted to mitigate the scarcity of women in STEM fields and create pathways for executive-level positions in which they can assume (American Association of University Women [AAUW], 2016). In the U.S., there is a dire need for innovation and ingenuity akin to leveraging creative engineering solutions to solve complex problems in a global economy (AAUW, 2016). Moreover, women are markedly underrepresented in STEM fields in the U.S. and many other countries (Mozahem, et al., 2019). Globally the number of female college graduates outnumber their male counterparts, yet females remain woefully underrepresented in STEM fields (Mozahem et al., 2019). Despite having earned college degrees as STEM majors from top universities, there are few women building careers in these fields (World Economic Forum, 2017). According to the World Economic Forum [WEF] (2017), only 26% of jobs in the technology sector are performed by women (WEF, 2017).

Thus, the shortage of women graduates is glaring on the international landscape (Mozahem et al., 2019). Furthermore, data published by the Organization for Economic Cooperation and Development (2012), substantiated this claim (Organization for Economic Cooperation and Development, 2012). The equality and representation of women in STEM fields have been a major plank concerning the political agenda of the United Nations Educational, Scientific and Cultural Organization (UNESCO, 2016). The UNESCO through the STEM and Gender Advancement (SAGA) project, developed during the years 2015 to 2018, has placed an emphasis on delivering lawmakers and policymakers tools to mitigate the mounting global gender gap in STEM (UNESCO, 2016). Interestingly, the scarcity of women in STEM professions is notably higher in the male-predominate field of engineering as compared to other STEM disciplines like mathematics and technology which make this issue *uniquely relevant* [italicized for emphasis] (OECD, 2015). The organizational policy that promotes gender equity and the empowerment of women and minorities in the workplace is paramount to bolstering contemporary economies (UNESCO, 2016). Although progress has been made in the past few decades, this issue of too few women in STEM fields persists and continues to have detrimental effects on the U.S. economy and economies worldwide (UNESCO, 2016).

Notwithstanding, the research findings of the respective study concerned the challenges successful female engineer executives in the oil and gas industry faced in their career trajectories. More importantly, it focused on the "best practices" they applied in mitigating such challenges. In so much as an "engineer" is a problem-solver, this paper underscores the problem-solving skills applied by female engineers when faced with adversity. From an empirical standpoint, to address the question defined at the beginning of this paper,
Bandura's Self-Efficacy Theory serves as the theoretical underpinning that informed the study.
The next section underscores the problem statement that further justified the need to expand this body of knowledge.

Statement of the Problem

Companies excel largely due to the creativity of their employees and the diversification of their workforces (OECD, 2018). Yet, the "leaky pipeline" phenomenon, i.e., the diminishing pool of female STEM graduates needed to promote ingenuity and provide solutions for contemporary challenges accounts for the failure of many women to reach their full potential (OECD, 2018). For example, while the interest in math and science may be apparent in boys and girls equally as early

learners, girls are less likely than boys to choose advanced math and science curriculum in high school, matriculate as a STEM major in college, or pursue a STEM-related career (OECD, 2018). Moreover, early exposure to STEM fields in female early learners was shown to be a determinant factor in igniting their interests in STEM (Corbitt & Hill, 2015). Therefore, the review of the literature illustrates how the professional development of teachers can create an environment conducive to 21st-century learning in the early years of learners.

Chapter 2: Literature Review

Teacher Professional Development on Student Learning

Professional learning experiences (PLEs) accord teachers the opportunity to improve their comprehension of mathematics and teaching styles (Heck, 2019). Mathematics education reform has shown to be in tandem with the professional development of teachers (Borko et al., 2014). Specifically, there is a consensus among educators, professional development is at the center of reform relative to student learning outcomes (Borko et al., 2014). Professional development is a term that includes a broad range of activities (Borko et al., 2014). Little (1987, p. 491) describes it as "any activity that is intended partly or primarily to prepare paid staff members for improved performance in present or future roles in school districts" (Little, 1987).

Views and values regarding teaching and learning have an impact on the teaching practices of teachers (Philipp, 2007). Conception consistent with mathematics learning is teachers perceive their roles as primarily introducing students to new procedures and providing them with concise instruction (Stigler & Hiebert, 1997). Conversely, teachers who are inquiry-oriented demonstrate dynamic views of mathematics and actively engage students in the construction of cognitive development (Ball, 1993).

Concerted efforts and initiatives have been put into place to ensure mathematics education has an impact on practice through an expanded and measurable scale (Cai et al., 2017). Content knowledge of mathematics teachers plays an integral role in the quality of mathematics instruction students experience in the classroom (Cai et al., 2017). This knowledge, known as mathematical knowledge for teaching (MKT), originates from Shulman's (1986) characterization of teachers' "content knowledge" (Shulman, 1986).The MKT includes a core understanding of the discipline and pedagogical content knowledge and competencies related to the demands of teaching (Shulman, 1986). The possibilities for expansion of professional development for mathematics teachers accorded by emerging learning formats are promising (Heck, 2019).

Early Exposure to STEM and 21st-Century Learning

In the 1980s, the "21st-Century Skills" movement took hold (National Education Association, 2016). Yet, educators were in a quandary as to the mechanics of moving 21st-century education forward (NEA, 2016). Moreover, the National Education Association (NEA) championed the 21st-century education initiative from the outset and worked collaboratively with teachers to assist in moving this agenda forward (NEA, 2016). Additionally, the NEA helped establish the Partnership for 21st Century Skills [P21] (NEA, 2016). And, in 2002, set out on a two-year journey to create

the "Framework for 21st Century Learning," which underscored 18 different skills (NEA, 2016). Over time, it was apparent the framework was unmanageable, thus, to resolve this issue, leaders from varying sectors were interviewed to determine which of the 21st-century skills were the most important for K-12 education (NEA, 2016). See Table 1 for the P21 framework for 21st-century learning and the corresponding rubric.

Table 1. The alignment of 21st-century learning components with the 21st-century learning design rubric.

P21 framework for 21st century learning			
4C's—Learning and innovation skills	**Information, media, and technology skills**	**Life and career skills**	**Key subjects—3Rs and 21st century themes**
Creativity and innovation	Information literacy	Flexibility and adaptability	Global awareness
Critical thinking and problem solving	Media literacy	Initiative and self-direction	Financial, economic, business and entrepreneurial literacy
Communication	ICT literacy	Social and cross-cultural skills	Civic literacy
Collaboration		Productivity and accountability	Health literacy
		Leadership and responsibility	Environmental literacy
21st century learning design rubrics alignment with P21 framework			
Knowledge construction	Use of ICT	Self-regulation	
Real-world problem solving			
Skilled communication			
Collaboration			

Note. Student 21st-century skills in selected exemplary STEM high schools. This image is from an open-access article distributed under the terms of the Creative Commons CC BY license, which permits unrestricted use provided the original work is properly cited.

As is apparent in the P21 framework for 21st-century learning and this body of knowledge, honing "critical thinking" and "problem-solving skills" boded well in the success of the respective female engineer executives. These engineer executives demonstrated "leadership" and "responsibility" when directing teams on highly technical projects and in interpreting well calculations for probable crude oil paths. Moreover, the respective engineers who served in executive-level capacities worldwide demonstrated "global awareness" combined with "social" and "cross-cultural" skills that enabled them to aptly manage and develop high-performing and multifaceted teams. Additionally, along their career trajectories, their "flexibility" and "adaptability" shown in multiple and progressive job assignments led to significant promotions, the garnering of divisions with tens of thousands of employees, oversight over multi-billion dollar budgets, and recognition from either the chair of the board or president of their respective oil and gas companies. These female engineers took exceptional pride in performing effectively in their jobs which were a common theme that reflected the highest frequency in commonality. Without fail, each of the participants

voiced sentiments regarding how well they performed on projects and in myriad roles. And, each took great pride in having the reputation as an expert, critical thinker or effective problem-solver.

Furthermore, having an unusually high work-ethic was recognized through accolades garnered while these female engineer executives served in leadership roles through professional organizations and associations, e.g., the Society of Women Engineers, National Society of Petroleum Engineers, and the American Institute of Chemical Engineers, just to name some. Additionally, most of the participants were not concerned about the next job opportunity; but rather, each became proficient in increasing competencies and mastering new skills in a current position. For example, in evaluating their teams, these engineer executives exhibited insight in assigning the appropriate STEM practitioner to a specific role relative to their background, expertise, and innovative and creative skills. As such, according to the P2 framework for 21st-century learning "financial, economic, business, and entrepreneurial" literacy, of which they acquired over their careers, boded well in their overall advancement. To make another point, by exhibiting a global mindset, these female engineer executives empowered teams that were culturally diverse and effectively interfaced with one another whether in person or via cloud platforms (Mendenhall et al., 2013). According to Rhinesmith (as cited by Mendenhall et al. 2014), a global mindset is inclusive of two components, intellectual intelligence and emotional intelligence (Mendenhall et al., 2013). Correspondingly, a global mindset is a concept that comprises a set of competencies universal in nature and exhibits the mindset needed to be an effective global leader (Mendenhall et al., 2013). These engineer executives where successful, in part, as they could aptly read the "tea leaves" and positioned themselves as global leaders in comprehending the contemporary workplace as a "global village." The following section of this paper focuses on the TIMSS exam which shows the academic performance of students at varying grade levels internationally. The TIMSS exam enables educational leaders and education policymakers to assess the competencies of would-be graduates relative to skills needed in a 21st-century economy.

U.S. Student Academic Performance in Cognitive Domains

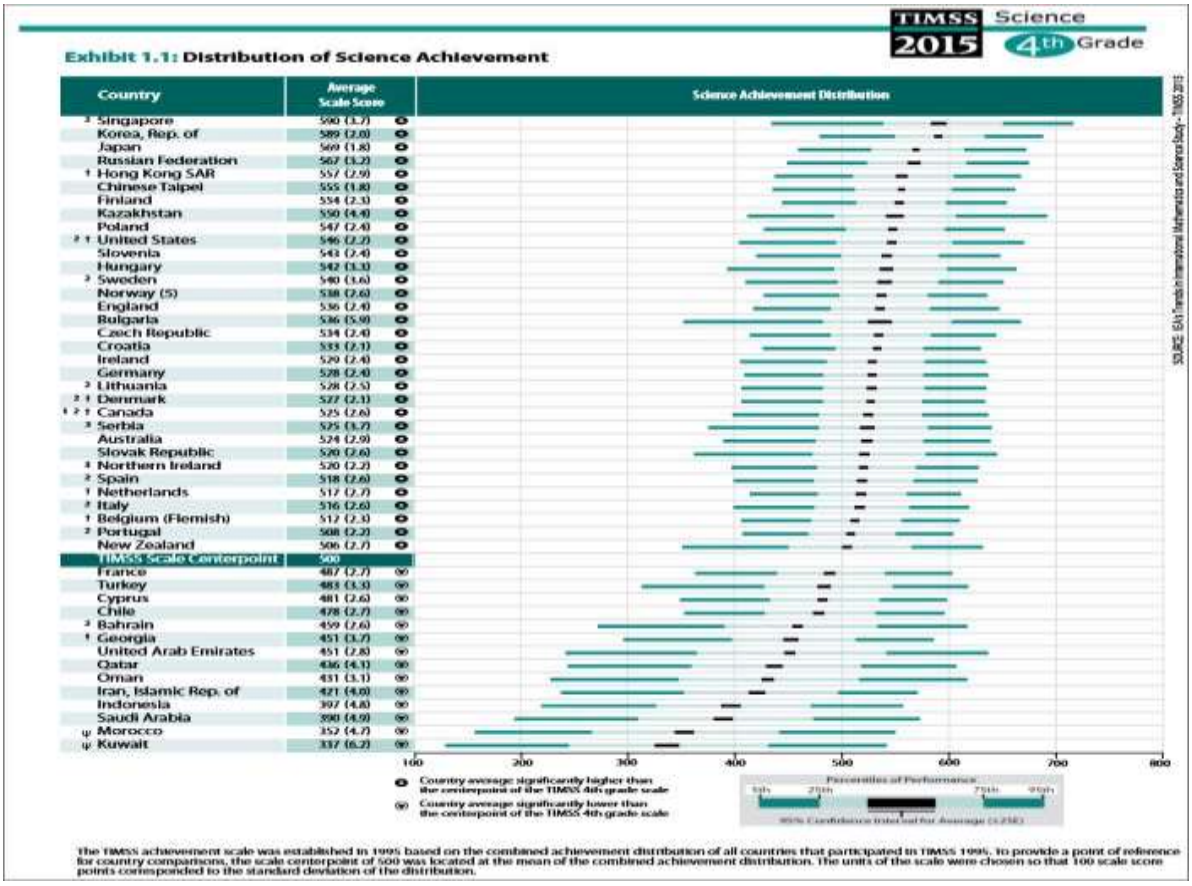
TIMSS 2015 Administration

Globally, benchmarking efforts based on the academic performance of primary school students are evaluated based on TIMSS, PISA, and PIRLS exams (Caliskan et al., 2018). However, neither exam carries the characteristics of competition among countries; conversely, the academic performance of students is evaluated in terms of a comparison of international competence (Caliskan et al., 2018). In this paper, the TIMSS exam is highlighted as it assesses student competence in the primary school years. The Trends in International Mathematics and Science Study (TIMSS) exam developed in 1995, is administered every four years and evaluates the knowledge and skills of students at the 4th and 8th- grade levels (Martin et al., 2015). Designed to measure math and science achievement of primary school students in participating countries, TIMSS is administered every four years in which the most recent administration and results were made available in 2015 (Martin et al., 2015). Moreover, TIMSS administrations cull information regarding the educational systems, curricula, and students and teachers alike to enhance mathematics and science education for monitoring developments among different countries

(Caliskan et al., 2018). According to the Economic Policy Institute – EPI (2013), U.S. education policymakers express great concern regarding the academic performance of American students on international exams (EPI, 2013). Those entrusted to reform education, monitor the frequent underperformance of U.S. students to rationalize secondary school policy changes based on what the TIMSS and the Program for International Student Achievement (PISA) exams show (EPI, 2013). Policymakers leverage the underperformance of American students to impact change through public policy decision-making (EPI, 2013).

Controlling for social class distribution, U.S. students have been unable to compete with students of top-scoring countries including Canada, Finland, and Korea (EPI, 2013). To address these dire academic outcomes, increased policy attention has been focused on Finland due to its students consistently outperforming U.S. students in multiple subjects (EPI, 2013). See Table 2, for TIMSS average scale scores of participating countries in science achievement from the 2015 administration.

Table 2. Distribution of Science Achievement



Note. In 1995, the TIMSS achievement scale was established based on the combined achievement distribution of all countries that participated in TIMSS during that year.

Students who inhabit countries such as Singapore and Hong Kong, spend a great deal of learning both in and out of school, resulting in a top performance in the PISA exam which tests those who are15 years of age (Anderson, 2019). Yet, countries like Finland where students

begin primary school at age seven (a) put in fewer hours, (b) on average get fewer take-home assignments, and (c) perform exceedingly well in myriad subjects (Anderson, 2019).

Project-Based Teaching and Learning

The concept of project-based teaching and learning is not new. It derives from the works of Dewey and Kilpatrick (Fardoun et al., 2014).) Yet, in recent decades it has experienced a resurgence resulting from the dire need for STEM graduates to assume jobs that spar innovation and ingenuity (Fardoun et al., 2014). The following quote illustrates how articles based on empirical research present its definition:

> Project-based science pedagogy is built around five features used to design activities that: (a) engage students in investigating a real-life question or problem that drives activities and organizes concepts and principles; (b) result in students developing a series of artifacts, or products, that address the question or problem; (c) enable students to engage in investigations; (d) involve students, teachers, and members of society in a community of inquiry as they collaborate about the problem; and (e) promote students' use of cognitive tools. (p. 411)

As such, each of the female engineers the author interviewed, purported in their early years they either attended private schools or those which offered academic rigor and a promise of high college placement rates. Moreover, some of the engineers had exposure to either an iteration of project-based learning (PBL) or problem-based learning (PBL). Additionally, the curricula in which they participated were constructivist and provided the opportunity for analytical skill development. As is apparent in this body of literature, these female engineer executives were team-oriented and delivered some of their most stellar performance metrics through the talents of their teams. As such, project-based learning is collaborative and heuristic at its core. Moreover, it hearkens to a "community of practice" in which experts and novices work in tandem with givers and takers (Farnsworth et al., 2016). Furthermore, these engineers exhibited transformational leadership styles using transactional approaches as was demonstrated in the pride they felt in facilitating the process of witnessing employees thrive and reach their full potentials which advanced their companies. These female engineers, themselves, overcame the challenges of finding their "voice." Yet, exuded confidence by identifying the right individuals for the right roles in developing effective teams.

Marshaling educators, scholarly associations, think tanks, academics, legislators, industry leaders, and philanthropists alike will undoubtedly engender myriad perspectives as to the ideal learning environment to cultivate 21st-century skills (NEA, 2016). Independently these groups recognized the importance of developing U.S students that bode the necessary skills to compete in a dynamic global economy (NEA, 2016). To create new technologies and provide unique solutions to complex problems, the training and preparation of today's students for innovation challenges ahead are imperative (OECD, 2019). With a multitude of issues facing our communities, inclusive of global change, immigration reform, pandemic diseases, and recessions, students of today must be equipped to solve these challenges (NEA, 2016).

Bandura's Self-Efficacy Theory

For this paper, the theoretical framework is shown through the lens of Bandura's (1986) Self-Efficacy Theory. As originated by Bandura (1977), the theory of self-efficacy was outlined as a theoretical framework "in which the concept of *self-efficacy* is assigned a central role, for analyzing changes achieved in fearful and avoidant behavior" (p. 193). This theory was premised on the notion "psychological procedures, whatever their form, serve as a means of creating and strengthening expectations of personal efficacy" (p. 193). Concerning the development of STEM interests, Bandura forecasts self-efficacy beliefs, and outcome expectations of an individual influences choice actions by acting indirectly on interests and choice goals (Lent et al., 2000). Lent et al. (2013) suggested a social cognitive career perspective would help clarify career development and choices across the lifespan
(Lent et al., 2000).

As was mentioned in chapter two of this paper, early exposure to STEM subjects and initiatives enabled these engineer executives to build their confidence in STEM through problem-based learning. Moreover, competing and partaking in science fairs, robotics competitions, and coding projects after school and during the summer months were instrumental in enhancing the self-efficacy of these female engineer executives. To make another point, the research revealed a high number of the respective female engineers were fascinated with STEM subjects early on, and the notion of being a problem-solver motivated them to excel while in college. Having taken Advanced Placement (AP) math and science courses and/or matriculating via a college preparatory curriculum elevated their pride as they received recognition accorded by teachers and their classmates. Furthermore, STEM magnet schools, STEM summer camps, and summer internships afforded these engineers hand-on experience conducive to building analytical skills.

Interestingly, it was common in their households for a mother, father, sibling, and aunt or uncle to work as an engineer. Thus, conversations around the dinner table allowed for the budding engineer to be immersed in the jargon of the profession. For example, terms such as upstream, downstream, onshore, and the language surrounding well calculations were typical day-to-day conversations heard throughout their childhoods.

Conclusion

In conducting the research, raw data were collected and interpreted via in-depth interviews with 11 female engineer executives and one female executive who was a geologist. Each had experienced rewarding careers as engineers in the oil and gas industry. Moreover, most of the volunteers had traditional families including two children, on average. Each executive was asked 12 open-ended interview questions which unearthed raw data regarding "best practices" and strategies they applied that led to their success in a male-predominate field. Despite the challenges, these female engineer executives faced, through girt they persevered and excelled. Some of the volunteers were born into families with low incomes, yet they were not daunted in their zest to succeed.

Although these female engineer executives endured myriad barriers, for future generations, one solution to mitigate these barriers lies in a society acknowledging explicit and implicit bias can render gender discrimination and inequity. Furthermore, many young women graduate from high school prepared to pursue a major in STEM, yet few pursue majors in STEM upon entering college. Fortunately, stereotypes, biases, and other cultural beliefs can change. By pinpointing gender bias, the process of demolishing it can begin.

Finally, by igniting the interest in girls of STEM subjects as early learners and creating workplace cultures that develop female leaders, we can experience the outcomes of a robust economy with a high standing on the world stage. An America where its citizens are challenged to reach their full potential devoid of prejudice and contradictions can recapture the morals of a true democracy. Finally, for future studies, it is recommended researchers identify female engineers who exited a STEM field and determine the drivers that led to their departure. Additionally, this research can be expanded by including other STEM professionals inclusive of scientists, technologists, and mathematicians who are building careers in the oil and gas industry.

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Utilizing Individual Z-scores to Measure Efficacy of the World's First Augmented Reality Glasses for Autism: A Single Case Study

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Abstract

The goal of this research was to demonstrate the effectiveness of Brain Power, the world's first augmented reality glasses for autism, utilizing BrainMaster's Z-Builder EEG analysis program to identify significant changes in an individual's qEEG when a standard normative population database appeared to be less sensitive to changes. Additional outcome measures included neuropsychological assessment and behavioral rating scales. Participant(s): The covid-19 pandemic occurred during the research time frame, therefore only one participant, a 12-year-old male diagnosed with autism and selective mutism was able to complete the required trials. Methods: 15 sessions of the Brain Power intervention were administered to the subject by a technician in a private office setting over a four-week period. Each session consisted of the subject wearing AI enhanced Google Glasses and performing AI assisted interactive tasks with the technician developed by Brain Power for a total of 15 minutes per session. Metrics used to demonstrate effectiveness included select neuropsychological tests, qEEG analysis and behavioral rating scales via a pre-post test design. Results: neuropsychological testing revealed significant improvements of at least one standard deviation in social perception and facial memory skills, with Z-Builder analysis indicating changes in specific regions of interest (ROIs) that may correlate to brain areas associated with the specific neuropsychological functions measured, the use of individualized Z-Builder detected significant physiological changes in the subject's EEG compared to analyses utilizing a normative population database; and behavioral rating scales revealed mildly significant improvement as rated by parents, but no significant behavioral changes were detected by the teacher. Conclusion(s): Continued research with larger sample sizes is needed to establish that the Brain Power intervention can reliably affect positive physiological change(s) in the EEG and in areas of neuropsychological functioning of specific interest to individuals with autism or social-communication disorders. Furthermore, BrainMaster's analysis program, Z-Builder appears to be particularly sensitive in detecting brain-based physiological change in individuals afflicted with complicated disorders, such as autism, suggesting a new paradigm in how qEEG analysis is performed.

Keywords: Autism, qEEG, Artificial Intelligence

Introduction

Autism Spectrum Disorder (ASD) is a neurodevelopmental condition that onsets during childhood. Over the past 20 years the United States has seen an increase in the rate of autism from 1 in 150 children in 2000 (CDC, 2013) to 1 in 54 (CDC, 2020) with few effective treatment options available such as medications, cognitive-behavioral therapy and applied behavioral analysis (ABA). Technological advances in computer sciences and artificial intelligence (AI) have made additional resources, such as neurofeedback (NFB) therapy, available to clinicians as an evidence-based treatment option. Along with advances in computer speeds and performance, quantitative electroencephalography (qEEG) has become an accepted tool for assessing and providing evidence of statistically significant changes in the EEG based on normative comparisons of EEG data. As more options are made available for treating autism, how does one assess more subtle changes to the EEG? The qEEG databases currently available compare an individual to a normal population. In specific clinical populations, such as autism, significant changes may not be detectable when an individual's EEG is compared to that of a normal population sample.

There is a need to provide inexpensive treatment alternatives to meet the needs of the growing ASD population which can be implemented in a timely manner. The Brain Power team has devised a technological intervention for the ASD population that utilizes Google Glass technology in order to deliver behavioral based intervention that is meant to increase "emotional understanding, face directed-gaze, eye contact, and self-control" (Liu et al., 2017). The Brain Power System (BPS) combines hardware and software that may be downloaded onto different smartglass platforms. The application has a variety of game-like modes that can be used in a tailored intervention in order to target a specific individual's needs. The application gives real-time auditory and visual feedback that is derived from software data analysis of the device's gyroscope and accelerometer to cue the user. There are multiple modes available in the application (such as Face2Face and Emotion Charades), that create a game-like atmosphere that are designed to encourage eye contact and the recognition of facial expressions respectively.

Evaluating the Brain Power System

For an intervention to be accepted it must not only be effective but also safe for the user. Sahin et al. (2018) sought to evaluate the safety of utilizing smart glass technology for ASD interventions. The BPS was introduced to a group of 18 pairs of participants—the users, who had a professional diagnosis of ASD, and the users' parent or guardian; the ages of the users ranged from 4.4-21.5 years. Two participants did not have the intervention administered as they could not physically wear the device for at least one minute. The parent or guardian was trained to use the system and commenced 10-minute sessions on three modules: Transition Master, Face2Face, and Emotion charades. However, the overall session times ran between 60 and 90 minutes to account for the ASD symptom severity of the users. Of the 16 users that were given a 60-90-minute session, only two users reported minor negative effects; none of the caregivers reported minor negative effects from using the device, nor did any of the pairs report any major negative effects. The minor

negative effects reported are dizziness, one case of eye strain, and one case of initial nasal bridge discomfort (Sahin et al., 2018). The nasal bridge discomfort was mediated by adjusting the device, the eye strain was remedied by a 20-second break, and the caregiver of the user that reported dizziness explained that the user was not wearing their prescription glasses and that they had also experienced dizziness while using Virtual Reality (VR) headsets. The two users who were not able to complete the session did not express that there were any adverse effects from the device, it was noted that they did not have an interest in wearing the device nor continuing the session—these participants were also non-verbal and relatively young (being 5.5 and 5.8 years old). The only design concern voiced by caregivers was that the device would become warm to the touch, however the heating of the smartglass did not produce any negative effects. The results indicate that the glass is safe to use and that a majority of people can be trained to use the BPS and users are likely able to wear the device and engage for a full session. The recommended session lengths are 10 minutes, and so for users of varying ages and severities being able to wear and use the device for over an hour demonstrates that the intervention is not extremely taxing on the user.

Liu et al. (2017) proposed that ASD interventions may benefit from incorporating and utilizing augmented reality. This may be done through the combined usage of visual and auditory cues while the user is engaged with the device and the social interactions between the user and a partner. This study had two participants who were tested with the Aberrant Behavior Checklist (ABC) before and after a single session using the BPS along with a user and caregiver report for feedback on interactions with the BPS along with emotional and behavioral changes. User interaction was regarded as high for both users in regard to engagement, tolerability of the device and apps, enjoyment, ease of use, and interaction with the device (Liu et al., 2017). Furthermore, the results of this study demonstrated that the BPS can improve behavior commonly associated with ASD, such as lethargy, social withdrawal, non-compliance, and hyperactivity (Liu et al., 2017). There was a negative change in emotional connection and behavioral control for one user; furthermore, there was no change in verbal communication for either user and no change in caregiver stress levels for one user. However, the greater amount of positive change after a single use, along with the high levels of interest reported indicate an advantage to using the system. Another advantage of introducing technological interventions, such as the BPS, lies in the technology's ability to record quantitative data of user progress and interaction with the device.

In order to determine the success of the BPS as an intervention for ASD, a single-case experiment was conducted on a 13-year-old male student diagnosed with ASD who received a three-week intervention, twice daily, using the BPS (Sahin et al., 2018). Each week the student's parents, the special education teacher, the general education teacher, and a paraprofessional teacher reported his behavior using the SRS-2. The student's parent, special education teacher, and general education teacher all reported improvement in the SRS-2 global scale along with improvements in the following subscales: social communication, social cognition, social motivation, and restricted interests and repetitive behavior; however, the paraprofessional teacher only administered one intervention and also did not note significant changes in the SRS-2 total score. The reports provided by the main teachers and the parents provide further evidence that the BPS intervention is related to improvements in social communication. Furthermore, the intervention was able to be done in a classroom setting concurrently with other class activities, indicating that the intervention can be done in natural environments that have greater sensory stimulation. However, the

intervention administered for the three weeks was only using the Face2Face module. This does not allow for evaluation of eclectic sessions utilizing different modes—such as Emotion Charades.

Furthering the viability for the BPS to serve as an intervention during the school day, Keshav et al. (2018) conducted an experiment in which the intervention was administered twice per day to a student over a two-week period. The teachers administering the intervention were asked to describe their experience with the device, specifically the technical and practical aspects along with the impact on the student and their thoughts on how well the intervention worked in a classroom environment. The two main teachers administering the intervention—the special education and general education teachers—both felt that the system was easy to use and manageable in the classroom. The third teacher, the paraprofessional teacher, noted that she did not fully understand the mechanics of the system nor the game-like experience; she also described that she felt her workload had increased—though she attributed this to the need for keeping documentation for the sake of the experiment. The special education and general education teachers also noted that the student had shown improvements in eye contact and participation in classroom activities, such as discussions; the special education teacher further stated that the student improved in making sustained eye contact even when the smartglass was removed. The general education teacher also noted that the student had improvement in conversation skills during the intervention. Both teachers stated that the intervention did not distract other students from their classwork, and while some were curious about the technology, it did not lead to any disruptions. The student expressed that he feared that he was missing out on activities while doing the sessions and so the general education teacher recommended that it is important to explain the purpose of the intervention so that the student would not feel stress or anxiety about other coursework and feel that the experience was worthwhile. This response indicates that since the initial introduction of the intervention would cause a change in routine, the common need for consistency and the rigidity associated with ASD could then cause the student some levels of stress.

Interventions using the BPS have been experimentally demonstrated to be safe and effective at improving some common problems that individuals with ASD experience. However, while one study utilized the SRS-2 as a standard measure to evaluate behavioral improvement, other studies used the SCQ or relied on subjective reporting provided by teachers, caregivers, and the users. There is also a lack of evidence for sustained changes after the length of the allotted intervention window. Furthermore, there is a lack of neurophysiological based evidence for improvements.

qEEG Studies for ASD

The Quantitative Electroencephalogram (qEEG) uses the recorded electrical patterns of the brain, the electroencephalogram, EEG, and processes them using computerized algorithms. The information obtained from an individual's qEEG is compared to a database of subjects who have been averaged in order to get a standard reading (Neubrander et al., 2011). The brain patterns of individuals with ASD have commonalities that have been identified in 6 different endophenotypes: epileptiform activity, mu pattern, high beta patterns (beta spindles), coherence dysregulation, high delta or delta/theta patterns, and low voltage slow EEG patterns (Neubrander et al., 2011). Identifying specific abnormalities in the brainwaves of individuals allows for personalized treatment, targeting the atypical patterns.

Coben et al. (2008) further identified differences in brain patterns for autistic individuals versus the control group. The ASD group ranged from ages 6 to 11 with the controls matched in age, gender, and IQ with a one-year age band to control for maturational changes in EEG data and IQ. The results showed that the ASD group had less absolute delta waves than the controls, with the largest reductions in the left frontal and posterior regions; the relative delta was globally reduced for the ASD group as well. Relative theta was shown to be greater in the ASD group, most significantly in the right posterior region, than the controls. The greater amounts of theta in that region indicate that the right posterior region is an area with abnormal functioning. The ASD group also showed higher midline beta power, which is commonly associated with difficulties in executive functioning and mental activity problems (Coben et al., 2008). Excess in beta is also associated with anxiety, poor integration, and irritability—all common symptoms experienced by individuals with ASD (Neubrander et al., 2011).

Treatments for ASD show not only a behavioral change, but a neurophysiological change. Coben and Padolsky (2007) demonstrated that neurofeedback treatments for individuals with ASD are effective in reducing ASD symptoms. The focus for the neurofeedback was different for each participant as the treatment targeted the regions with maximum hyperconnectivity. The control group had no significant changes in the parent ratings of symptom severity along with neuropsychological measures, with 83% of the parents reporting no change; however, 89% of parents reported an improvement in ASD symptoms. For the control group, there was also a trend for the cerebral hyperconnectivity to increase while the opposite was observed in the experimental group. The qEEG results showed that 76% of the experimental group had a decrease in cerebral hyperconnectivity. The reduction of this hyperconnectivity is associated with positive clinical outcomes which was reflected in the Autism Treatment Evaluation Checklist, in which there was a 40% reduction in ASD symptoms after receiving treatment. The combination of psychological testing along with the qEEG results demonstrate that the common physical manifestations of ASD change depending on treatment and are linked with an improvement in symptoms.

Method

Participants

The intervention was conducted on a 13- year-old male student that had received a formal diagnosis of ASD and selective mutism. The student was a high functioning student who was fully included in regular education classes at the public middle school he attended at the time of the study.

Measures

The single case study design included two rounds of assessment: baseline and post assessment for all three outcome measure categories: rating, scales, neuropsychological assessment, and qEEG brain mapping assessment.

Rating Scales

The rating scales employed for the current case study included the Social Communication Questionnaire-Current Form (SCQ), the Social Responsiveness Scale- 2nd Edition (SRS), and the Behavior Rating Inventory of Executive Functioning- 2nd Edition (BRIEF-2). The SCQ is a brief instrument which helps evaluate communication skills and social functioning in children over age 4.0, as long as his or her mental age exceeds 2.0 years, who may have autism or autism spectrum disorders. The SRS-2 is a rating scale which identifies the presence and severity of social impairment within the autism spectrum and differentiates it from that which occurs in other disorders for age ranges from 2 years, 5 months through adulthood. The BRIEF-2 measures executive functioning in home and school environments and is regarded as an efficient way to evaluate impairment of executive function in children and adolescents with neurological conditions, such as learning disabilities, ADHD, traumatic brain injury, low birth weight, Tourette's Disorder, and autism.

Neuropsychological Assessment

The NEPSY- 2nd Edition (NEPSY-2) is an individually administered and standardized assessment used to assess neuropsychological development in children ranging from 3 to 16 years old. The 32 subtests of the NEPSY-2 are designed to assess neuropsychological functioning across six domains: attention and executive functioning, language, memory and learning, sensorimotor, social perception, and visuospatial processing. The current case study focused on NEPSY-2 subtests assessing social perception (affect recognition and theory of mind) and immediate memory and learning (memory for faces and memory for names).

qEEG Assessment

Quantitative Electroencephalography (qEEG) is a procedure that processes the recorded EEG electrical activity of the brain from multiple sensors using an amplifier connected to a computer. The acquired EEG is processed with various algorithms, such as the Fast Fourier Transform (FFT). Using statistical analysis, the metrics are often compared to a normative database of reference values and colorized brain maps are the result of the analysis. QEEG information is used as a tool to interpret areas of brain dysregulation and function by various experts. Pre and post qEEGs allow for tracking of changes in brain function due to various interventions such as neurofeedback, exercise or medication. The current case study design also employed BrainMaster's Z-Builder EEG analysis program to identify significant changes in an individual's qEEG based upon the hypothesis that traditional qEEG analysis approaches using normative comparisons appear to be less sensitive to changes in atypical population samples. The research team decided to use BrainMaster's Z-Builder EEG analysis program to compare the individual to their own baseline qEEG analysis (Collura & Tarrant, 2020).

Treatment: The Intervention

About the Brain Power System

The Brain Power System (BPS) utilizes smartglass technology in order to deliver behaviorally based intervention for children and adults with Autism Spectrum Disorder (ASD). The intervention is meant to increase "emotional understanding, face directed-gaze, eye contact, and self-control" (Liu et al., 2017). The BPS combines hardware and software that may be downloaded onto different smartglass platforms. The application has a variety of game-like modes that can be used in a tailored intervention in order to target an individual's specific area of need. The application gives real-time auditory and visual feedback that is derived from software data analysis of the device's gyroscope and accelerometer to cue the user.

Emotion Charades

Facial cues are an important aspect of human interaction, displaying a variety of information regarding "emotion, intention, attention, and understanding speech" (Sahin et al., 2018). Individuals with Autism experience difficulty with recognizing, perceiving, and processing due to impairments in social cognition and social motivation. Emotion Charades is meant to increase the user's level of emotional processing. The game-mode presents an augmented reality situation in which the partner is prompted to make a certain expression—such as happiness, sadness, or anger—and the user is asked to match the expression to an emoticon by tilting their head to one side. Emotion Charades requires the partner to pair a device, such as a cell phone or tablet, to the smartglass in order to receive the expression prompts. The partner is also given example questions to ask the user—When was the last time you felt angry?, What makes you happy?, What would you do if your friend was sad?, etc.—to make the connection between emotions and expression stronger and more personal.

Face2Face

The goal of Face2Face is to decrease gaze indifference and eye aversion, encouraging users to direct their attention to the face of their partner and keep the gaze focused. The game-like mechanics are meant to increase social motivation and cognition along with targeting gaze aversion and gaze indifference (Sahin et al., 2018). Persistent focus on the face of a partner prompts visual rewards such as stars appearing and a mascot character to appear over the face of the other person; this then gives further motivation to retain focus. The failure to maintain a face-directed gaze causes cues such as arrows to draw the user back to the face of the partner. Game elements—such as snapshots of the session, duration of the session, and number of stars earned—are recorded and saved onto an online portal. Graphs are available on the online portal that measure the rewards earned versus session time and facial attention versus session time.

Transition Master

Autism Spectrum Disorder is commonly marked by social impairments; such impairments are also linked to anxiety experienced by individuals with ASD (White et al., 2010). Transition Master aims to decrease levels of stress and anxiety that would otherwise be associated with a new

environment. The online portal allows users to upload 360° images that are accessible through the user profile on the smartglass Empower Me application. Multiple environments can be explored for the user to become familiar with places they have yet to visit. The 360° nature of the images allows the user the ability to turn and look all around the environment and offers an immersive experience while the user is still in a controlled environment.

Procedure

The recommended session time is 10 minutes per day for 5 days per week; with results appearing as quickly as three weeks of use. The current case study averaged 15-20 minutes of playtime per session with 3-4 sessions taking place per week for 4 consecutive weeks. This totaled 15 sessions in alignment with the total minutes recommended by the developers. The sessions used an eclectic approach to intervention, utilizing each of the aforementioned applications in order to deliver a rounded experience with the BPS. During the sessions, active conversation took place in order to foster social skills while increasing visual attention.

Results

The single case study design employed a pre-post assessment design for all three outcome measure categories: rating, scales, neuropsychological assessment, and qEEG brain mapping assessment utilizing a normative database (Neuroguide) and a new assessment technique, BrainMaster's Z-Builder, where the client serves as their own baseline for measuring effectiveness. Pre-intervention baseline data was obtained less than a week prior to the intervention and post-intervention assessment occurred within 2-4 days of the subject's last session using the BPS intervention.

Rating Scales

Before the augmented reality Brain Power intervention was implemented, the subject's parent and regular education teacher completed the three different behavioral rating scales utilized in the study. These behavioral rating scales primarily measure social communication and attention skills with two of the rating scales, the SRS-2 and SCQ, designed to specifically measure behavioral traits deemed typical of students suspected of or already diagnosed with autism. The third scale, the SCQ, provides an overall score designed to provide a cut-off score for diagnostic considerations for autism. Figures 1 and 2 list the t-score values for each of the rating scale composite scores for the SRS-2 and the BRIEF-2. The t-sore values are structured such that t-score values below 60 are considered to be typical or fall in the average range compared to a standardized, normative population. T-score values between 60-65 are classified as mild indications of atypicality for the construct measured, representing only 6-16% of the population of individuals of the same age group. T-score values between 66 and 75 are classified as moderate indications of atypicality, representing only 1-5% of the population norms. T-score values above 75 are classified as severe indications of atypicality, representing less than 1% of the population norms. According to the SRS-2 manual, scores in the severe range indicate deficiencies in reciprocal social behavior that are clinically significant and lead to severe interference with

everyday social interactions. Such scores are strongly associated with a clinical diagnosis of an autism spectrum disorder.

Figures 1 and 2 indicate that after 15 sessions of the intervention administered over the course of four consecutive weeks, the subject's level of behavioral symptoms as rated by his regular education teacher did not change significantly. However, parent-based ratings did reveal some significantly positive changes for a few of the scales. Overall, the subject's parents rated his behavior to be significantly more atypical when compared to the teacher rating scales during the pre-intervention phase. Of the 11 scales reported in figure 2, the teacher only indicated one of the scales, social motivation, to fall above the typical range with a t-score of 60 falling in the mild range of functioning or 84th percentile rank. In contrast, the parent rating of the subject's pre-intervention behaviors revealed six out of the 11 scales to fall within the mild to moderate range. Furthermore, half of the six scales that yielded significant pre-intervention t-score values fell in the severe range or > 99th percentile rake for the social communication index, social communication, and social motivation. One scale, the social communication index t-score, fell in the moderate range or 99th percentile rank. The remaining third of the six scales fell in the mild range for restricted and repetitive behaviors (84th percentile rank) and social awkwardness (94th percentile rank). Post-intervention t-score values according to teacher-based ratings were essentially unchanged with the qualitative exception that the subject's social motivation score dropped one point from a t-score of 60 to a 59, dropping his classification category from mild to within normal limits. However, this decrease of one t-score point was not statistically significant. In contrast, the post-intervention t-scores difference values yielded from parental ratings did reach statistical significance for three for the six scales identified as atypical prior to the intervention by just meeting the 10-point difference threshold for t-score comparison of pre-post values for the overall SRS-2 total composite score (74 vs. 64), the social communication composite score (76 vs. 66), and the BRIEF-2 emotional regulation index (52 vs. 42). However, the t-score value for the BRIEF-2 emotional regulation index remained within the normal limits range both prior to and after the four-week intervention period. In addition, one of the six scales, social communication, which was endorsed as falling in the severe range (>99th percentile rank) prior to the intervention, social communication, revealed a t-score difference value of 14, thus dropping his classification to the mild range (94th percentile rank). Finally, the SCQ cut-off score difference remained clinically unchanged for both teacher and parent when pre- and post-intervention scores were compared.

Figure 1

Parental Rating Scales

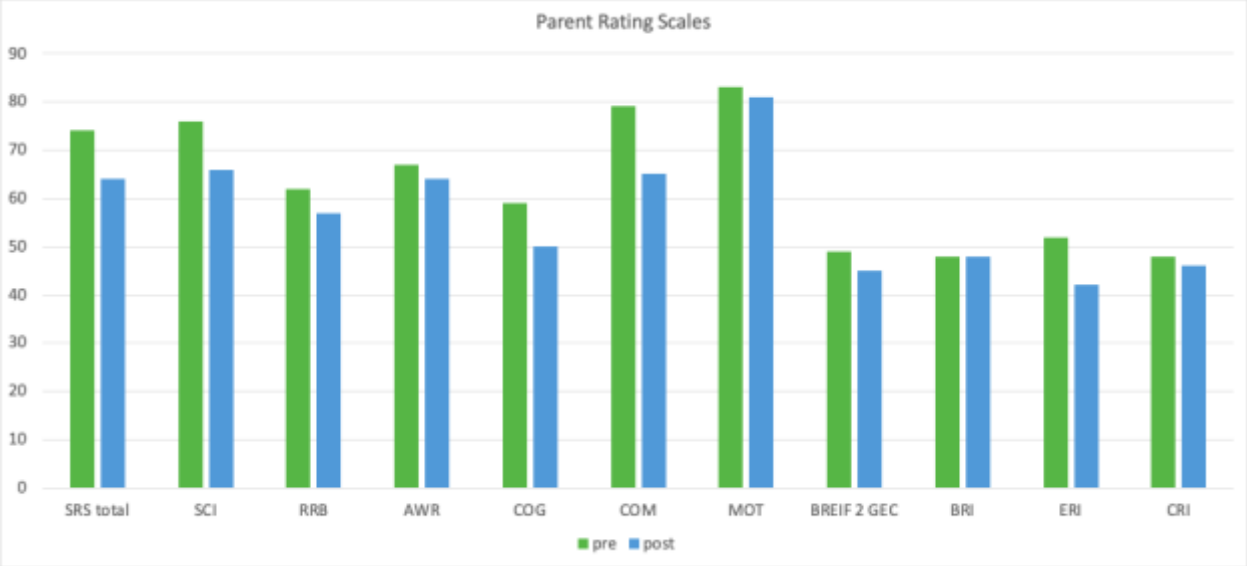
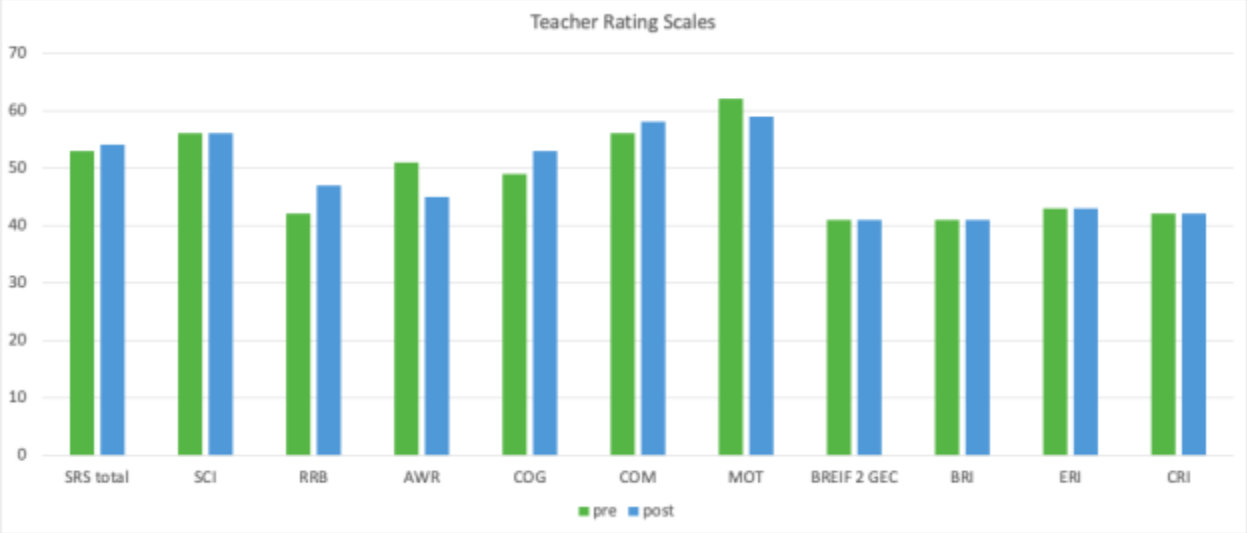


Figure 2

Teacher Rating Scale



Neuropsychological Data

Prior to the Brian Power intervention, the subject was administered five subtests of the NEPSY-2. The obtained scores are based on a normative population sample and reported according to the normal distribution curve. Therefore, a scaled score of 10 represents a score typically obtained by 50 percent of the normal population of the same age as the subject assessed in the current study. Based upon the normal distribution parameters, one standard deviation is defined as a difference of 3 scaled score points. Prior to the intervention, the subject displayed significant deficits in visual memory (memory for faces) and slight, but also significant deficits in their verbal social reasoning/communication skills (theory of mind: verbal). Analysis of the pre-post neuropsychological test data revealed significant improvement not only in pre-established areas of deficits as defined by normative population statistics (visual memory, verbal social reasoning/communication), but also improvement in areas which were initially within the average range (affect recognition and visual social reasoning). The results depicted in Table 1 indicate that the subject improved at least one standard deviation in four of the five NEPSY-2 social perception subtests administered. The greatest improvement was evidenced in the subject's ability to recall and distinguish between subtle facial features (memory for faces), resulting in a positive 1.33 standard deviation change during post-testing which also resulted in a qualitative change in clinical classification from the below expected level (5th percentile rank) to the average range (37th percentile rank).

Table 1

Neuropsychological Data

NEPSY-2 Subtest	**PRE Scaled Score (X=10, SD=3)**	**Clinical Classification**	**POST Scaled Score (X=10, SD=3)**	**Clinical Classification**	**Significant Difference (Yes/No)**
Affect Recog.: Total	11	At Expected	14	Above Expected	**YES**
Memory for Faces	5	Below Expected	9	At Expected	**YES**
Memory for Names: Immed. Learn	14	Above Expected	14	Above Expected	NO
NEPSY-2 Subtest	**PRE Percentile Range**	**Clinical Classification**	**POST Percentile Range**	**Clinical Classification**	**Significant Difference (Yes/No)**
Theory of Mind : Total	26 - 50	At Expected	51-75	At Expected	**YES**

Theory of Mind : Verbal	11 - 25	Slightly Below Expected	51-75	At Expected	**YES**

qEEG Analysis

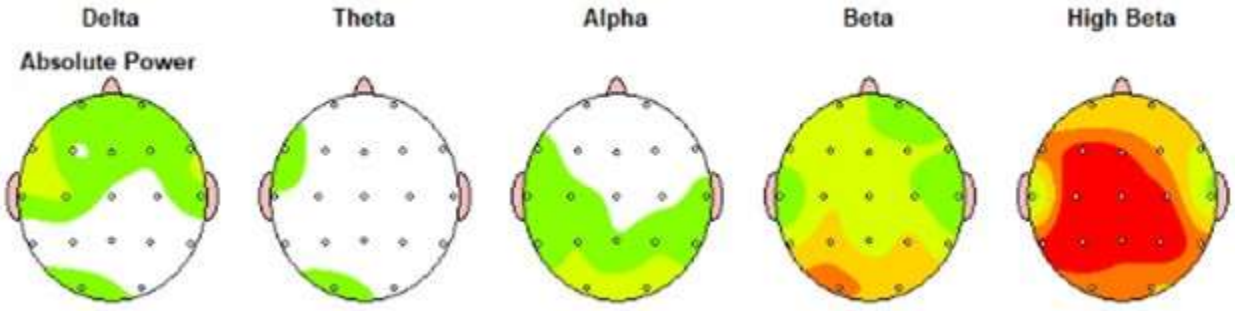
Database 1: Neuroguide Normative Database

The results of the generated brain maps from the normative database did show change, however the changes that did occur were not statistically significant based on the brain maps themselves, nor was it possible to tell with precision any exact region of interest (ROI) that may have shown a significant change. For this initial study, the Z-Score analysis of the absolute power metric was utilized for analysis where the colors depicted in the maps below indicate the amount of standard deviation represented as z-scores. The pre-post charts below suggest this individual presented with excessively high levels (3 standard deviations from that of a normative sample) of Beta brainwave patterns in the left occipital region and excessively High Beta brainwave patterns in the central, frontal and occipital regions that remained consistent across timed assessments. That is, the subject's level of dysregulated brainwave patterns remained relatively unchanged according to the normed data base. However, qualitative analysis did reveal a trend toward significance in the amplitude of the beta waves located in the left occipital region (O1) as indicated by the difference in pre-Z-score value (2.10) and the post Z-score value (1.74).

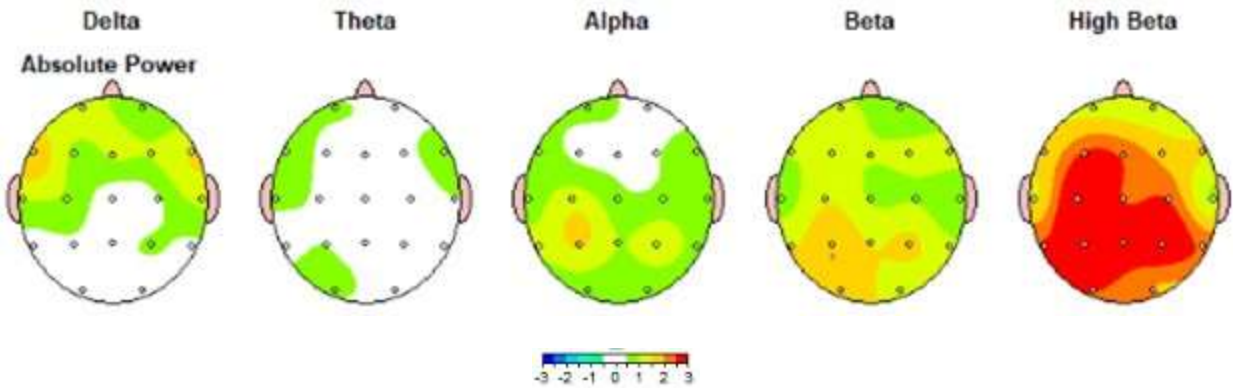
Figure 3

Normative Database Brain Maps

PRE



POST



Database 2: BrainMaster's Z-Builder EEG

When performing the analysis using Z-builder, which compares the individual to their own baseline qEEG analysis, significant changes were evidenced in the alpha band, (8-12Hz), more specifically with changes/activation occurring in the Alpha 1 (A1) band, (8-10Hz) and deactivation occurring in the Alpha 2 (A2) band, (10-12Hz). Because the Z-builder analysis program does not provide a brain map comparison of pre-post differences, the chart below represents brain regions of interest (ROI) produced by the Z-builder analysis, which indicates the Z-score levels of difference when comparing the pre-post EEGs. The chart below only provides numerical data for ROIs for which a Z-score, or standard deviation, of one or higher was obtained. Therefore, only significant changes are illustrated in the chart below for the A1 and A2 brainwave bands. Many of the ROIs listed indicate a significant change post-intervention, corresponding to the neuropsychological data (NEPSY-2 subtests) and behavioral skills data (rating forms) which also revealed significant post-intervention changes, suggesting multiple confirming outcome measures indicative of significant change following the BPS intervention.

Table 2

Z-Builder Analysis of Statistically Significant Changes in all ROIs and Bandwidths

ROI name	Alpha-1 L	Alpha-2 L	Alpha-1 R	Alpha-2 R
Occipital Lobe	0.102	-0.835	-0.031	-1.030
Cuneus	0.122	-0.868	0.013	-1.019
Inferior Occipital Gyrus	0.052	-0.767	-0.122	-1.008
Inferior Parietal Lobule	1.120	0.419	0.729	-0.011
Lingual Gyrus	-0.053	-1.005	-0.143	-1.158
Paracentral Lobule	1.178	0.429	1.154	0.393
Postcentral Gyrus	1.240	0.546	0.903	0.220
Precentral Gyrus	1.219	0.585	0.917	0.322
Brodmann 1	1.128	0.529	0.757	0.166

Brodmann 2	1.223	0.555	0.818	0.150
Brodmann 3	1.261	0.572	0.943	0.267
Brodmann 4	1.263	0.581	0.985	0.317
Brodmann 5	1.209	0.454	1.138	0.371
Brodmann 6	1.315	0.619	1.133	0.437
Brodmann 8	1.162	0.589	1.121	0.470
Brodmann 17	-0.131	-1.113	-0.192	-1.200
Brodmann 18	-0.007	-0.967	-0.109	-1.125
Brodmann 24	1.040	0.468	0.979	0.397
Brodmann 40	1.100	0.396	0.713	-0.019
Brodmann 43	1.010	0.441	0.525	0.115
Central Exec. Net.	1.040	0.392	0.675	0.030
Hagmann 1	0.126	-0.803	-0.030	-1.022

Results from Table 2 were analyzed further and thus yielded sLORETA images of the ROIs most closely associated with the NESPY-2 neuropsychological test results. Figure 4 illustrates the sLORETA images specific to the central executive network (affect recognition), brodmann area 8 (memory for faces), and brodmann area 24 (theory of mind).

Figure 4

Neuropsychological Data Related to Brain Regions

Discussion

This study set out to determine whether the BPS smartglass intervention would have any effect on the client's EEG via quantitative analysis of the participant's neuropsychological functioning, EEG brainwave patterns, and associated behavioral changes as assessed by standardized rating scales. The present case study was successful in establishing that the BPS had a significant positive effect on improving the participant's social awareness and attention skills across all three outcome measures employed. These positive effects were more consistent and robust on direct assessments of neuropsychological measures and less robust in the behavioral ratings as rated by the participant's parent and regular education teacher. Although prior studies by Sahin et al. (2018) did reveal significant changes in behavioral rating scales, the current participant's regular education teacher may not have been sensitive enough to the participant's behavioral functioning. In contrast, we believe that future research should seek, when possible, input from special education teachers that work more closely with the students on a regular basis and are more attuned to the behavioral patterns of autistic students. However, as was the case in the present study, some high functioning autistic students may be fully included in their school setting and not have a specialized support staff that instructs or regularly interacts with them. In such cases, the parental rating form should likely represent a more sensitive measure of behavioral change following the BPS intervention. In fact, the present case study results did reveal some quantitative positive changes in the participant's social communication skills as rated by the parent. Another factor associated with high functioning autistic students and outcome effects is their tendency to have pre-existing superior functioning in specific areas. For example, prior to the BPS intervention the current participant demonstrated a heightened ability for verbal labels. Perhaps the most promising outcome of the current case study is the evidence that the BPS augmented reality intervention produced a consistently significant and positive effect on the participant's social communication skills across the three varying assessment modalities (behavioral rating scales, neuropsychological

assessment, and qEEG analysis), thus providing multiple confirming data to support the effectiveness of the BPS intervention. Furthemore, when qualitatively analyzing the specific areas of improvement across the three main outcome measures, the participant demonstrated consistent improvement in correlating areas of functioning. For example, the Face2Face application focuses on improving a participant's visual attention to the specific facial features of the facilitator during training using BPS, as students with autism or social communication disorders tend to avoid direct eye contact and do not process detail oriented visual stimuli specific to a person's facial expressions. The current participant's most prominent change after using the BPS for 15 sessions was evidenced in his increased ability to effectively attend to and interpret visual information which translated into significant changes in direct measures of neuropsychological functioning (memory for faces) and qEEG brainwave patterns (Broadman Area 8 and O1 beta levels).

This study also represents the first attempt to determine whether the BPS smartglass intervention would have any effect on the client's EEG via quantitative analysis. In order to determine this, we used two approaches: the first approach utilized a traditional, normative database to evaluate the client's qEEG, the second approach used a new technique developed by Brainmaster (Z-Builder) using the client's individual EEG as the reference database or baseline.

While the traditional EEG normed population database did reveal changes in the client's EEG, the changes could be left to clinical interpretation without specificity to precise quantitative changes nor to specific Regions of Interest (ROIs). But, when the client's individual EEG served as the baseline, the analysis by Z-Builder provided a more precise analysis of the client's change with specificity to specific ROIs. Specific changes of at least 1standard deviation were seen in the following EEG bandwidths: Alpha1, A1, and Alpha2, A2. Changes were seen at locations: Broddman areas 1,2,3,4,5,6,8,17,18,24,40 and 43. Changes were also noticed in the following brain areas or ROIs as well: occipital lobe, cuneus, inferior occipital gyrus, lingual gyrus, paracentral gyrus, postcentral gyrus, and precentral gyrus. The central executive network and the hagmann-1 network also revealed changes of at least 1standard deviation. Many of the listed ROIs are associated with the neuropsychological skills assessed in the study via the NEPSY-2, which focused on social communication, attention, and affect recognition skills. More specifically, the alpha band is associated with shifting attention from an internal focus to an external focus, or from the default mode network to the central executive network. A1-slow Alpha, is associated with emotional processing and often appears more in the frontal lobe of the brain while A2-fast Alpha, is found occipitally and is associated with background memory processing and is considered an idle, yet attentive state. Z-builder was able to detect a change of at least 1standard deviation in the aforementioned areas and bandwidths which were directly associated with the NESPY-2 neuropsychological test results. Given the nature of the BPS intervention and the ability to detail changes of the EEG in specific brain regions using Z-Builder, further research is warranted to further support current test results with a larger sample size as Brain Power has been shown to have the potential to be an effective modality in treating the ASD population after only 15 sessions with the Brain Power System. Furthermore, current research suggests that qEEG is an effective measurement tool for demonstrating the effects of neurofeedback on an individual as compared to a normal population. The present case study results suggest that Z-Builder may be a more powerful tool to demonstrate changes of an individual's EEG when using any various forms of interventions, especially when serving an atypical population such as those with ASD.

While the present study represents the first of its kind to both measure and demonstrate the effectiveness of the world's first augmented reality (AR) smartglass intervention (BPS) on direct measures of neuropsychological functioning and physiological changes in brainwave patterns (qEEG), further research is needed to replicate these findings with an expanded sample size and possibly even include a control group. Therefore, a controlled study on a larger sample population is suggested and our observations are only suggestive of the impact the Brain Power System had on the individual examined in this case study. Additionally, future research should further examine the use of Z-Builder as a more sensitive and reliable approach to measuring client-based change in response to interventions in order to more accurately guide and revise a client's individual treatment plan.

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