2018

Exploring Stress for Novice Teachers' in Low Socio-Economic Elementary Schools Through Breathing Biofeedback

Angelica Fulchini
University of Central Florida

EXPLORING STRESS FOR NOVICE TEACHERS' IN LOW SOCIO-ECONOMIC ELEMENTARY SCHOOLS THROUGH BREATHING BIOFEEDBACK

by

ANGELICA FULCHINI
B.S., University of Florida, 2011
M.Ed., University of Miami, 2013

A dissertation submitted in partial fulfillment of the requirements
for the degree of Doctor of Philosophy
in the Department of Child, Family, and Community Sciences
in the College of Education and Human Performance
at the University of Central Florida
Orlando, Florida

Summer Term
2018

Major Professor: Lisa A. Dieker

ABSTRACT

Teachers who serve children of color in schools that support students from low socio-economic status have turnover rates reported to be as high as 70% (SES; Carver-Thomas & Darling-Hammond, 2017). Numerous approaches to teacher retention in low SES settings have been discussed in the literature (Chester & Beaudin, 1996; Donaldson, 2009; Ingersoll & Kralik, 2004; Jacob, 2007; McKinney, Haberman, Stafford-Johnson, & Robinson, 2008; McLaurin, Smith, & Smillie, 2009; Siwatu, Frazier, Osaghae, & Starker, 2011; Sutcher, Darling-Hammond, & Carver-Thomas, 2016; Taylor & Frankenberg, 2009), but the use of emerging biofeedback technology is an unexplored territory. This type of technology could help novice teachers understand basic changes in stress levels through awareness of the body and mind while teaching. Hence, the potential use of biofeedback strategies to reduce stress levels in teachers, in inclusive settings, that serve students with low SES is explored.

To help potentially reduce novice teachers' stress levels (Friedman, 2000; Day & Hong, 2016; Isenbarger & Zembylas, 2006), the researcher explored the effectiveness of biofeedback on breathing rates of teachers in inclusive classrooms serving more than 50% of students from low SES backgrounds. The researcher found, by tracking the rate of stressed breathing of 9 teachers during the instructional day, that teachers reported they were more mindful of their breathing. The researcher found meetings, paperwork, and student behaviors increased their stress and suggested better mentorship as a way to help reduce stress. The paper concludes with implications for practice, and recommendations for future research for teachers is provided.

This dissertation is dedicated to my father, Jerry Fulchini, my mother, Karen Scott-Fulchini, my grandma, Sylvia Scott, and my fiancé, Austin Scruggs. Their unconditional love, patience, encouragement, sacrifices, and support has allowed me to overcome every obstacle and get through every step of this journey.

Also, to all of my inspirational students I have taught in Overtown and Pine Hills and their incredibly supportive families who took me in as one of their own family members. You are the true reason I am here, and I will forever keep my promise to ensure you all receive an excellent education. Without you, I would not have had the love and drive to be where I am right now. You make me miss the classroom every day and made me love this profession! I cannot thank you enough.

ACKNOWLEDGMENTS

To my parents, Gerardo and Karen, whose love, support, guidance, and patience has never wavered, even through all of my ups and downs, stress, anxiety, fears, and frustration. Thank you for encouraging me to do what I wanted, no matter what, and not forcing me to become a lawyer but supporting me when I decided education was my calling. Thank you for making trips to my classroom to set up every year and storing all of my supplies in the garage at the end of every year. Thank you for providing my students with every holiday celebration, books galore, and even clothes when needed. Thank you for working hard your entire lives and still working to this day, so that I could have everything I have ever wanted in life. To my grandma, Syliva Scott, who had as much of a part in raising me as my parents did. You are the real MVP! Thank you for never doubting me and always inspiring me to be a strong, independent woman. Thank you for always reminding me that no one can ever take away my education and encouraging me to always pursue my dreams. Mom, Dad, and Grandma, thank you for teaching me to be kind, honest, humble, to be thankful, to work hard, to be tough, and to never give up. Thank you for believing in me when I didn't believe in myself. I would not be the person I am today if it were not for you. I hope I have made you proud!

To my fiancé, Austin: thank you for helping me grade papers when I was in the classroom and supporting my students at science fairs, field trips, and performances. I would not have applied to this program if you did not hold a piece of my heart here in Orlando. I know that this program has not been easy on you, so thank you for sacrificing so much these past three years and being so patient so that I could fulfill my lifelong dream. Thank you for putting up with my tears, my bad moods, my sleepless nights, my stress and anxiety, my emotional break

downs, and the events we had to miss so that I could collect data, write, or work. Most importantly, thank you for always putting a smile on my face and reminding me how ridiculous I am being at times. We have been through a lot in our years together, but through everything, our relationship has only become stronger. I cannot wait to marry you in November and become Dr. Fulchini-Scruggs (we can discuss the hyphen later). I love you, and I cannot wait to start the next chapter of our life together!

To my role model, mentor, and dissertation chair, Dr. Lisa Dieker. Thank you for being so supportive and inspirational during this PhD journey. I will forever be in awe of your drive, passion, intelligence, and incredible work ethic. Thank you for guiding me, for your constant support, for always alleviating my anxieties and concerns, for teaching me how to make a strong presence, for allowing me to discuss my disabilities, and for pushing me out of my comfort zone on a regular basis. Thank you for all of the late nights spent editing and the early mornings spent encouraging me to be the best educator I can be.

To my deceased grandparents, Angelina and Nicola Fulchini, and James Scott. I know that you have all helped me in ways I could not even begin to imagine. Know you are always with me.

To my committee: Dr. Martha Lue Stewart, Dr. Rebecca Hines, and Dr. Michael Hynes, thank you, first and foremost, for the time you have dedicated to supporting me in this process. Thank you for your words of wisdom, for your brilliant ideas and questions, and for teaching me how to be an innovative, passionate, and collaborative educator.

To the UCF faculty: Dr. Nicole Damico, Dr. Charlie Hughes, Dr. Matt Marino, Dr. Trey Vazquez, Dr. Suzanne Martin, Dr. Wilfred Wienke, Dr. Mary Little, Dr. Cynthia Pearl, thank

you for allowing me to learn from you and for providing me with so many wonderful, rich learning experiences. You are all amazing mentors, and I feel blessed to have had the opportunity to work with and get to know each of you.

To my cohort: Faith, Rebecca and Celeste. It has been quite a ride. Faith, thank you for being my partner-in-crime, for our venting sessions, and for being a wonderful collaborator and colleague.

To my UCF colleagues: those who came before me, those who came after me, and those in other disciplines- specifically Caitlyn McKinzie Bennett, Matthew Taylor, Jillian Schreffler, Whitney Hanley, Jamie Best, Annette Romualdo, Benjamin Gallegos, Taylor Bousfield and Dena Dillenseger Slanda. I could not have possibly been surrounded by a more inspirational, strong, and passionate group of scholars.

To the amazing, brilliant minds at the Office of Special Education Programs at the U.S. Department of Education, especially Drs. Larry Wexler, Terry Jackson, and Greg Knollman, thank you for welcoming me with open arms to my summer internship, for teaching me about policy, and for your mentorship.

To my friends for life: Danielle, Victoria, Jordan, Nia, Dylan and Jordan, Susanna and Dom, Louis and Jess – thank you for being so understanding of my crazy schedule and never once faulting or judging me for it.

To Donna, Porsha, Jake and D.J.: Thank you for adopting me into your family, allowing me into the family group chat, and including me in all the fam drama throughout this UCF journey! Donna, thank you for keeping me sane and letting me vent whenever I wanted to. Thank

you for spending lunches with me and always pushing me to be my best. There is absolutely no way I would have been successful in this program if it wasn't for you.

To my dogs, Fendi and Gucci Mane, my little writing buddies! You always knew how to greet me on a bad day and when I needed your unconditional love. Fendi, you will always be my first baby who has been through every up and down with me since 2011. Thank you for being one of my most fiercely loyal protectors. Fendi and Gucci, thank you for always warming my heart with your ridiculous personalities.

To the teachers and principals who so graciously allowed me to come into your classrooms and wore the Spires – I definitely could not have done this without your support.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

AAPB- Applied Psychophysiology and Biofeedback

BCIA- Biofeedback Certification International Alliance

DP- Depersonalization

EE- Emotional Exhaustion

EHA- Education for All Handicapped Children Act of 1975

ESEA- Elementary and Secondary Education Act

ESSA- Every Student Succeeds Act

HEA- Higher Education Act

HLP- High-Leverage Practices

IDEA- Individuals with Disabilities Education Act

IEP- Individualized Education Programs

IRB- Institutional Review Board

ISNR- International Society for Neurofeedback and Research

LEAs- Local Educational Agencies

fMRI- Functional Magnetic Resonance Imaging

MBI- Maslach Burnout Inventory

NCTAF- National Commission on Teaching and America's Future

NCLB- No Child Left Behind

NEA- National Education Association

PA- Professional Accomplishment

SES- Socioeconomic Status

SWD- Students with Disabilities

SWOD- Students without Disabilities

TSI- Teacher Stress Inventory

UCF- University of Central Florida

CHAPTER ONE: INTRODUCTION

Statement of the Problem

Financially, teacher turnover across the country costs school districts approximately $7.3 billion, including the cost of recruiting, hiring, and training new teachers. The cost of a teacher leaving the field is estimated to be as high as $17,862 per teacher (Barnes, Crowe, & Schaefer, 2007; Ryan, Nathaniel, Pendergast, Saeki, Segool, & Schwing, 2017). Novice teachers experience a high rate of stress (Perda, 2013), which researchers have shown leads to teacher burnout (Barnes et al., 2007; Podolsky, Kini, Bishop, & Darling-Hammond, 2017). Teacher attrition is an ongoing issue in schools, with higher rates found in schools where teachers serve students from low SES backgrounds. Teachers exiting in these settings personally and financially impact both teachers and students. Some researchers (Barnes et al., 2007; Podolsky et al., 2017) believe if novice teachers could be adequately supported in the first five years of teaching, the financial and personal savings could be astronomical.

The actual costs of the teacher turnover rates are difficult to calculate, but the response has been the creation of numerous approaches to increase teacher retention (Chester & Beaudin, 1996; Donaldson, 2009; Ingersoll & Kralik, 2004; Jacob, 2007; McKinney, Haberman, Stafford-Johnson, & Robinson, 2008; McLaurin, Smith, & Smillie, 2009; Siwatu, Frazier, Osaghae, & Starker, 2011; Sutcher, Darling-Hammond, & Carver-Thomas, 2016; Taylor & Frankenberg, 2009). Despite the emergence of retention plans, coaching, formalized programs, and various techniques, the changes in retaining teachers has yet to be recognized in many communities, with the highest rates being reported in low SES communities.

While it has been long understood that teacher burnout is a problem (Gelder, Gath, & Mayou, 1989; Hodge, Jupp, & Taylor, 1994; Hughes, 2001; Barnes et al., 2007; Podolsky et al., 2017), finding ways to combat this issue has proven difficult in practice. Mentoring, professional learning communities, and professional development have been used to help ease the stress of new teachers with mixed results (Day & Gu, 2007; Kwakman, 2003; Bayar, 2014; Caspersen & Raaen, 2014). Novice teachers report the outcome of these various approaches may not be what is needed if they are not given strategies to help cope with the stresses encountered upon entering the field of teaching (Barnes et al., 2007; Sutcher et al., 2016; Podolsky et al., 2017).

New approaches to managing teacher stress are possible with advances in technology, through increased societal and technological attention on wellness devices (Lewis, Napolitano, Buman, Williams, & Nigg, 2017). One such technological tool, often used to help lower stress in medical fields, is biofeedback (Friedman, 2000; Stein, 2001; Reiner, 2008; Schwartz & Andrasik, 2017). Biofeedback involves the voluntary control of physiological mechanisms such as breathing rate. The benefits of receiving this type of biofeedback have been found in fields such as nursing (Ratanasiripong, Ratanasiripong, & Kathalae, 2012; Ratanasiripong, Park, Ratanasiripong, & Kathalae, 2015) to reduce anxiety, tension, and stress. While reviews of literature on stress management techniques have noted that the benefits of using biofeedback in numerous professions (Friedman, 2000; Stein, 2001; Reiner, 2008; Schwartz & Andrasik, 2017), the use of this type of tool and feedback to reduce stress for novice teachers in schools serving students from low SES backgrounds has yet to be explored. Raising teachers' awareness of the issue of stress and burnout, specifically for novice educators serving students from low SES

backgrounds using biofeedback as a technique to alleviate stress, could prove to be valuable in potentially combating burnout in the teaching profession (Friedman, 2000).

The potential use of emerging tools in biofeedback to help reduce the stress of novice teachers who serve in classrooms, where more than 50% of their students are from low SES, is the focus of this study. Providing novice teachers with simple feedback and strategies to help cope with their stress may increase teacher retention while decreasing stress and burnout rates.

Purpose of the Study

The purpose of this study is to explore the effectiveness of biofeedback on breathing rates of novice teachers in inclusive classrooms, serving students who, 50% or more, are from low SES backgrounds, to potentially decrease their stress and burnout rates. The term SES is defined broadly as access to financial, social, cultural, and human capital resources; more specifically, a student's SES includes parental educational attainment, parental occupational status, and household or family income, with appropriate adjustment for household or family composition (NCES, 2012). The term low SES background is defined as children who are less likely to have a "school-like" home and follow a daily routine; they have lower indexes or resources available, including economic, social, and cultural resources (NCES, 2012; Walpole, 2003; Tucker-Drob & Harden, 2012; Duncan & Magnuson, 2005). A novice teacher is defined as teachers within the first five years of teaching who have completed pre-service training or preparation programs (Gray & Taie, 2015).

Specifically, the researcher focused on stress created by the classroom environment and tracked breathing patterns during a teacher's instructional day by providing awareness of tense

breathing to make teachers more mindful of their breathing/stress rates while teaching in inclusive settings. By monitoring and alerting teachers of their tense breathing, using a biofeedback tool called the Spire, Inc., teachers potentially could become more aware of what triggers stress in the classroom. An awareness of stress may involve noticing body sensations, observing thoughts, and becoming aware of emotions, related to stress, to allow teachers to practice self-compassion (Flook, Goldberg, Pinger, Bonus, & Davidson, 2013). Self-compassion is defined through different components, including self-kindness versus self-judgment, a sense of common humanity versus isolation, and mindfulness versus over-identification when confronting painful self-relevant thoughts and emotions (Goetz, Keltner, & Simon-Thomas, 2010; Wispe, 1991; Neff, 2003). While mindfulness has been identified as a promising means for cultivating attention and reducing stress, few researchers have investigated the approach of tracking novice teachers' breathing and the potential impact this feedback could have on their perceived stress and burnout.

Significance of the Study

The researcher in this study investigated the effect of biofeedback on perceived stress and burnout of novice elementary teachers in inclusive classrooms, with more than 50% of their classroom including students from low SES backgrounds. Although studies in teacher retention in low SES schools have examined why teachers burnout, these researchers have not examined what novice teachers can do to reduce stress to be retained in inclusive, low SES elementary classrooms (Sutcher, Darling-Hammond, & Carver-Thomas, 2016; Carver-Thomas & Darling-Hammond, 2017; Podolsky et al., 2017; Ryan, Nathaniel, Pendergast, Saeki, Segool, & Schwing,

2017). In conducting this study, the researcher anticipates a) contributing to the scant literature base on reducing stress and burnout using biofeedback, b) revealing findings of what creates tense breathing for novice teachers in low SES classroom environments, and c) guiding the field of education on using biofeedback with novice teachers.

Operational Definitions

Novice teacher: Novice teachers are teachers within the first five years of teaching who have completed pre-service training or preparation programs (Gray & Taie, 2015).

Low Socioeconomic Status: Children who are less likely to have a "school-like" home and follow a daily routine; they have lower index resources available to the student, including economic, social, and cultural resources (NCES, 2012; Walpole, 2003; Tucker-Drob & Harden, 2012; Duncan & Magnuson, 2005).

Burnout: A psychological syndrome of emotional exhaustion, depersonalization, and reduced personal accomplishment. These feelings can occur specifically with individuals working with other people in some capacity (Maslach, Jackson, & Leiter, 2006).

Stress: Stress, a psychological demand, can be defined as the problematic outcomes referred to as the cause of emotional distress, known as anxiety, depression, and psychosomatic complaints (Day, 1998).

The Maslach Burnout Inventory (MBI)- Educators Survey: The MBI-ES is the most widely used research instrument to measure burnout (Maslach, Jackson, & Schwab, 1986). Respondents are asked to indicate agreement with statements about feelings related to jobs, and the only modification of the version of the MBI for educators is items refer to

"students" instead of "recipients" (Maslach, Jackson, & Leiter, 2006). The MBI-ES consists of 22 items and yields scores along three dimensions: emotional exhaustion (EE), depersonalization (DP), and professional accomplishment (PA).

The Teacher Stress Inventory (TSI): The TSI is used to assess occupational stress. The TSI measures 10 factors that comprise the construct of teacher stress, and is composed of 49 items. Five factors represent sources of stress and five represent manifestations of stress. Stress strength is rated on a 5-point Likert-type scale. The total stress score is used to determine where teachers fall on a continuum of more to less stress (Fimian, 1988).

Spire Inc.: The Spire, Inc. is a wireless tracker worn as a clip on the waistline or chest. It provides immediate biofeedback on tense breathing, measures the teachers' breathing patterns, reminds them to take deep breathes, and provides guided programs on the mobile application to assist the teacher with correct breathing and mindfulness-based stress reduction strategies (Kelling, Pitaro, & Rantala, 2016).

Breathing: The only stress-related autonomic function that an individual can have direct conscious control over (Sherwood, 2006). Breathing patterns robustly reflect cognitive and emotional stress (Plarre, et al., 2011), calm (Sherwood, 2006), and concentration (Vlemincx, et al., 2011) while being responsive to being consciously manipulated to relax and deregulate the nervous system (Sherwood, 2006).

Theoretical Framework

Reducing the mental load of preservice teachers aligned with work, stress-related events is the theoretical framework for this study. This framework is based on the work of Gaillard and

Wientjes (1994), who created a theory that encapsulates the concept of "mental load" and the relationship to work stress. Gaillard and Wientjes' (1994) theory notes that in professions where there is high demands but low control of the tasks (e.g., in teaching), the outcome can be the development of stress symptoms.

Gaillard (2001) developed a theory of stress demands after reviewing the research literature and concluding that stress has several dimensions, including (1) an input function (work demands, emotional threat, or adverse environment), (2) an output function (pattern of behavioral, subjective, and physiological responses- strain), (3) an affective state (in which one feels strained and threatened subjectively), and (4) a process (resulting in a degraded work capacity). He argued that complex or novel tasks require greater resources than do simple, well-trained tasks. For novice teachers, most tasks are more complex as novel situations arise when they enter the field of teaching. Gaillard (2001) notes a person can "try harder" as an effortful response to a complex situation and can sustain his or her performance for brief periods, but the outcome is a high physiological and psychological costs (measured via stress and fatigue). He also found intense and negative emotional responses can have a deleterious impact on performance. These responses can disrupt the state of self-regulation, distracting the person from processing the task information, and causing psychosomatic symptoms that demand additional attention, further increasing stress and anxiety. Figure 1 shows the response of a person when in a stressful situation that does not allow them to work to their full potential.

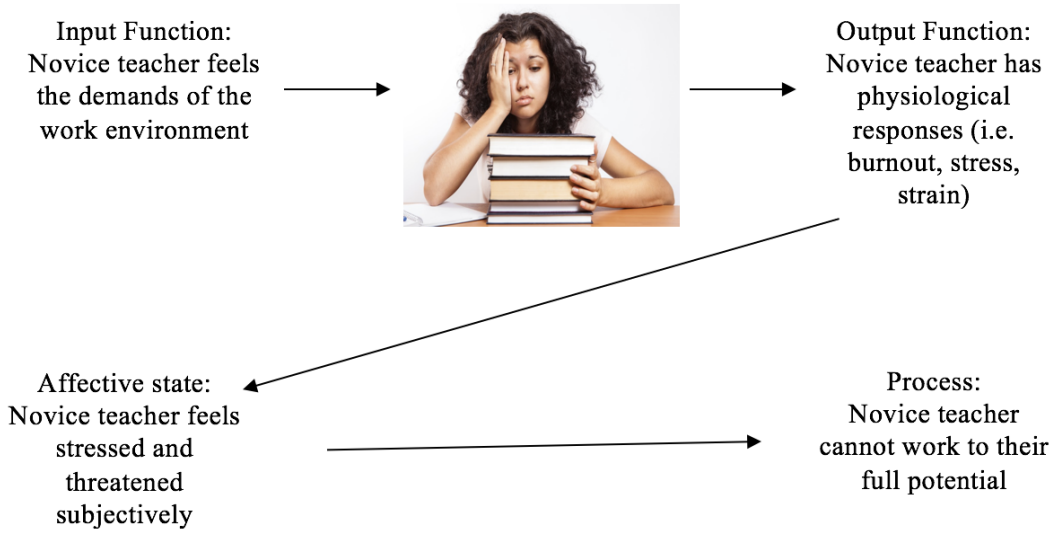


Figure 1: Adapted from Gaillard's Theory of Stress Demands (Gaillard, 2001).

In Gaillard's Theory of Stress Demands (2001), he distinguishes between mental load and stress. Mental load manifests itself as normal mental effort (a healthy coping strategy) while stress is an enhanced activation of the body and brain (heightened state of emotion) that fails to improve performance. When a task is attempted with strong state regulation, the amount of effort is minimized to complete the assigned task. Gaillard (2001) viewed one's mood as arising from either the positive or negative emotions associated with challenges under mental load based on threat perception. Gillard (2001) found when someone is coping effectively, mental load tends to be task-focused, but when under stress, the response appears to be emotion-focused. Without effective emotion regulation and coping strategies, teachers are more likely to experience higher levels of stress and emotion-focused coping leading to burnout, especially on the dimension of emotional exhaustion (Chang, 2009). Teachers need to effectively understand mental load and their response to both emotion-focused coping and task-focused coping in order to implement strategies essential to easing stress and burnout (Lazarus, 2006; Chang, 2009).

For this study, the researcher used biofeedback from a device called Spire, Inc. to make teachers aware of stress and stressors in the classroom, so they can manage stress “in-flight” and return to a positive state of regulation. The Spire, Inc. is a wireless tracker worn as a clip on the waistline or chest. It provides immediate biofeedback on tense breathing, measures the teachers’ breathing patterns, reminds them to take deep breaths, and provides guided programs on the mobile application to assist the teacher with correct breathing and mindfulness-based stress reduction strategies (Kelling, Pitaro, & Rantala, 2016).

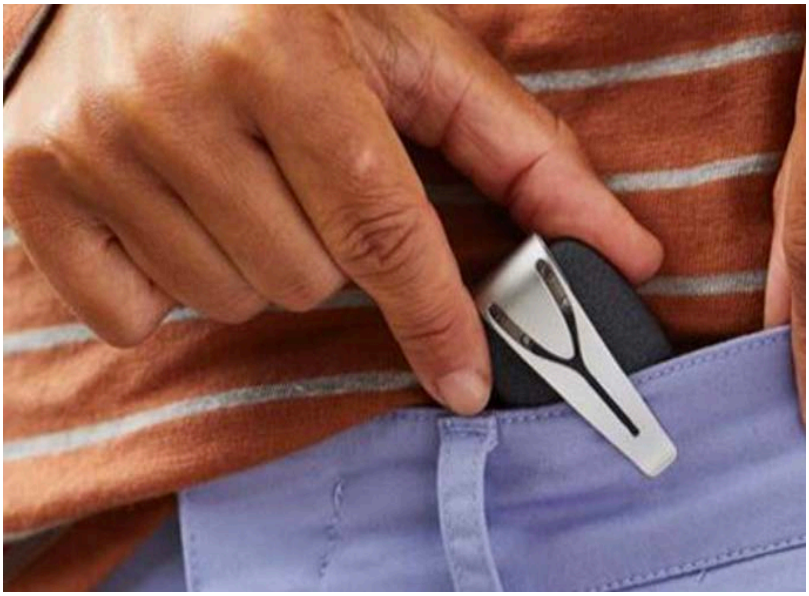


Figure 2: Spire device (Spire, 2018).

The purpose of the Spire is to determine continuous respiration sensing, real-time interventions, and actionable feedback to monitor teachers’ breathing and use breathing to help reduce stress (Spire, 2018). The following research questions guided the researcher in collecting teacher use of biofeedback from the Spire in low SES, inclusive classrooms.

Research Questions

The following research questions were explored in this study:

(1) To what extent does the use of a biofeedback device affect novice teachers' (1-5 years' experience) breathing patterns in inclusive elementary classroom environments, where 50% or more of the population are students from low SES backgrounds?

(2) To what extent does the use of a biofeedback device change perceived stress levels based on the Teacher Stress Inventory pretest and posttest?

(3) To what extent does the use of a biofeedback device change perceived burnout levels based on the Maslach Burnout Inventory pretest and posttest?

(4) Social Validity Question: To what extent do teachers believe the goals, procedures, and outcomes of a biofeedback device, using breathing feedback, is an effective means of reducing stress as discussed during final interviews?

Organization of the Study

A quasi-experimental design was used to assess the changes in breathing rates on overall, perceived stress of individual novice teachers. Comparison of pretest and posttest breathing rates for each participant, using the biofeedback device, the Spire, were compared. Additionally, a comparison of changes were discussed for each breathing rate score on the TSI and the MBI-ES to provide an individualized discussion of each participants' patterns, scores and perceptions.

Quasi-experimental designs are used to test hypotheses about the effects of manipulatable treatments but lack the process of random assignment (Shadish & Luellen, 2005). In this study, all teachers used the Spire for three days, during instruction, and all teachers at the end of the

study continued to wear the Spire during instruction for a final comparison measure. They also provided daily ratings of stress and completed a pre-post assessment by completing the TSI and the MBI-ES. To control for teacher bias effects and to increase generalizability of results, all teachers used the Spire during instruction.

A simple t-test was used to compare each participant's pretest and posttest data from the Spire, and levels of significance were compared to the TSI and MBI-ES scores. Nonparametric statistical analysis occurred across participants to show how each participant varied in their performance from the group of participants' means on each data collection tool. Finally, social validity data were summarized descriptively.

Table 1

Organization of the Study

	Group (n = 9)
Days 1-3	All participants wore Spires during instruction.
Day 4	All participants completed the TSI, MBI-ES and wore Spires during instruction.
Days 5- 25	All participants wore the Spires during instruction All participants completed a daily stress inventory to indicate their daily stress level from a 1-4, one being not very stressed and a four being very stressed, while participating in the study (See Appendix C).
Day 26	All participants completed the TSI, MBI-ES, wore Spires during instruction, and completed the Social Validity inventory.
Days 27-30	Researcher conducted informal interviews.

On day 26, the researcher collected all Spire data and distributed the MBI-ES and the TSI. Once complete, all scores were recorded in an Excel spreadsheet. The data were then analyzed to discuss changes observed within and across participants.

CHAPTER TWO: LITERATURE REVIEW

Being a novice teacher is difficult (Castro, Kelly, & Shih, 2010; Sydnor, 2017; Worthy, 2005; Zeichner, 2005). Equally difficult is retaining a stable work force, especially for those in their first five years of teaching when teacher turnover rates are high (Atteberry, Loeb, & Wyckoff, 2017; Darling-Hammond, 2010a; Guarino, Santibanez, & Daley, 2006). Turnover rates in the first five years of teaching are cited to be between 40-50% (Ingersoll & Merrill, 2012), and novices attribute their leaving due to stressors within the school environment (Ingersoll & Smith, 2003). The rate of turnover is even higher in classrooms where teachers have a high presence of students from low SES backgrounds, with rates reported as high as 70% (Carver-Thomas & Darling-Hammond, 2017).

One potential tool, which has not yet been formally explored in education to address this problem, is self-directed feedback using emerging technology devices. With the emergence of technology and biofeedback, the potential exists to help novice teachers develop a beginning understanding of simple changes in their stress levels. The use of biofeedback to increase awareness of stress in the classroom for novice teachers is the primary focus of this mixed methods research study.

In this literature review, the researcher focuses on the use and potential impact of biofeedback on novice teachers in low SES schools. The researcher provides a summary of the influence of legislative changes on the high rates of stress experienced by novice teachers (Perda, 2013). A summary of teacher preparation and the shortages that exist in low SES schools is also provided (Ladson-Billings, 1999; Jacob, Vidyarthi, & Carroll, 2012). A summary of the literature about factors leading to teacher burnout in inclusive, low SES elementary school

classrooms is then provided (Barnes et al., 2007; Podolsky et al., 2017). The chapter concludes with how biofeedback tools that incorporate breathing techniques could potentially reduce stress and burnout of novice teachers (Stein, 2001; Reiner, 2008; Schwartz & Andrasik, 2017).

Legislative Actions that Expanded the Inclusivity of Low SES Classrooms

The need for retention of teachers in general is apparent. Supporting student demographics has changed in the twentieth century. Students from a wide range of backgrounds with a wide range of abilities are, today, granted access to public school settings (Ladson-Billings & Tate IV, 1995), and teachers note they feel increased pressure for higher academic outcomes for all learners (Cooper & Travers, 2012; Skaalvik & Skaalvik, 2015; Croft, Roberts, & Stenhouse, 2016). Beginning in the 1950's, significant changes occurred not only in teacher education, but also towards improving academic success for all students. Brown vs. Board of Education in 1954 opened the door to educational access and higher expectations for all learners. The Supreme Court justice, in this landmark legislation, stated individuals cannot be segregated based upon irreversible characteristics such as race or disability (Yell, Rogers, & Rodgers, 1998). Chief Warren, on May 14, 1954, delivered the opinion of the Court, stating that "We conclude that in the field of public education the doctrine of 'separate but equal' has no place. Separate educational facilities are inherently unequal. . ." (Brown v. Board of Education, 1954). From the outcome of this legislation, many teachers needed further preparation to widen their skill sets in working with students they had never taught before, and in some cases, had never met, depending on their geographical location (Blanchett, Mumford, & Beachum, 2005; Darling-Hammond, 2000).

The population in teachers' classrooms further expanded in 1965 to include children of poverty. The Elementary and Secondary Education Act (ESEA) was signed into law in 1965 in an attempt to eliminate poverty (Parmenter, 1970). President Johnson believed full educational opportunity should be our first, national goal (U.S. Department of Education, 2014), and funding was offered to districts serving low-income students in the form of federal grants for text and library books, special education centers, and scholarships for low-income college students. Title I of ESEA provided financial assistance to local educational agencies (LEAs) and schools with high numbers or percentages of children from low-income families to help ensure that all children met challenging, state academic standards (U.S. Department of Education, 2014). Yet, teacher preparation changes historically lagged behind changes in access for more diverse learners (Darling-Hammond, 2006; Darling-Hammond, 2007).

The continued shift towards greater access for a wider range of learners moved forward in the late 1960's and early 1970's with the era of access and equality for students with disabilities (Cuban, 1993; Skiba et al., 2008; Darling- Hammond, 2015). The move from discussion of need to action occurred in 1975 with the passage of The Education for All Handicapped Children Act, where students with disabilities gained access to schools and classrooms. This act required all students with disabilities receive a free, appropriate public education and provided a funding mechanism to help with the excess costs of offering such programs.

This law also added new responsibilities for teachers and districts with the introduction of prescriptive procedures. To receive funds, the state departments of education and local school districts had to put in place a system to locate all students with disabilities (Martin & Terman,

1996). Districts then had to perform evaluations to determine the effect of the disability on educational performance, along with annual meetings producing an individualized education program (IEP) for each student with a disability. These steps were required to ensure the individualized plan was carried out in the least restrictive environment, which meant, in some cases, working with the general education teacher in the regular education setting (Martin & Terman, 1996).

Despite numerous changes in legislation and increased pressure on teachers, no funding was allocated to retool teachers to prepare them for the increased demands with a wider range of learners in their classrooms (Blanchett, Mumford, & Beachum, 2005). The original intention of the proponents of ESEA was to help students of low socioeconomic status (Thomas & Brady, 2005), and the intention of IDEA was to help students with disabilities improve academic outcomes on challenging, state academic achievement standards; however, without retooling the teaching force, those mandates were not realized as intended. Both laws were passed with good intent to impact learners, yet the best approaches and practices to help students meet these standards were not emerging in teacher preparation programs nor being disseminated in professional development programs in many districts (Darling-Hammond, 2006; Darling-Hammond, 2007).

These collective legislative actions (IDEA, ESEA, Brown vs. Board of Education) also began to have a direct impact on shaping the preparation and certification of all teachers. These changes, some would say, began to lead to teacher shortage and retention issues as certification demands to work with students with disabilities increased and demands in practice equally increased (Ladson-Billings, 1999; Roth & Swail, 2000). Teacher preparation programs were

required to respond to these shifts in practices by changing their program content and, often, by adding additional course requirements; however, diversity or disability was only discussed superficially, and the outcomes of these changes meant additional cost for licensure to work with students in many diverse settings (Ladson-Billings, 1999; Darling- Hammond, 2016; Bales, 2006). In practice, many districts provided professional development through a course, workshop, or presentation on diversity. Collectively, these minor shifts failed to address the preparation of teachers for more diverse populations found in schools and classrooms, especially in urban and rural settings (Ladson-Billings, 1999).

Path of Teacher Preparation for Diverse Learners

In 15 years, from 1965 to 1980, teachers in classrooms moved from a homogeneous group of students to the expectation of meeting the needs of students with a wide range of abilities, disabilities, learning styles, backgrounds, cultures, and personalities while ensuring they addressed higher and more robust standards of learning monitored at the local, district, state, and national levels (Shepherd et al., 2016). The pressure to teach a wider range of students, while ensuring every student achieved academic excellence, created an increasing level of stress and daily pressure on the teaching force. This pressure also transferred to teacher education programs where faculty members struggled with the best way to be nimble and respond to these changes in classroom environments and expected learner outcomes across content areas (Darling-Hammond, 2000). While this change was occurring, the field of teacher education began to see a shortage in teachers, especially in high poverty areas and in special education (Ladson-Billings,

1999; Darling-Hammond, 2000; Bales, 2006; Jacob, Vidyarthi, & Carroll, 2012; Barnes et al., 2007; Podolsky et al., 2017).

This level of stress and potential teacher shortages that begin in the mid 1980's continues today (Ladson-Billings, 1999; Jacob, Vidyarthi, & Carroll, 2012; Barnes, Crowe, & Schaefer, 2007; Podolsky et al., 2017) and parallels the progression and struggles found in teacher preparation programs. The push to change teacher practice gained momentum almost 20 years after the passage of Brown V. BOE and ESEA, with a national emphasis on standardized preparation and federal support being garnered for teacher preparation beginning in the mid-1980's (Liebman, 1990; Superfine, 2011). The Office of Special Education offered federal support for teacher preparation with discretionary grants to institutions of higher education and other non-profit organizations through Part D of IDEA. The funding was to support research, demonstrations, technical assistance and dissemination, technology, personnel development, and parent-training and information centers (OSEP, 2015). A collection of analysts, policy makers, and practitioners of teaching and teacher education pushed for the founding of national teaching standards and centralizing expertise to build effective practices, while trying to ensure a more knowledgeable and skillful professional was created to meet the range of diverse learners entering the classrooms (Darling-Hammond, 2010b). This same push for standards was also aligned with a push for federal support for teachers in high poverty areas and special education. This push for more rigorous and robust standards resulted in The National Commission on Teaching and America's Future (NCTAF, 1996), creating a set of policy initiatives to design professional standards, strengthen teacher education and certification requirements, increase investments in induction, create mentoring programs, and provide professional development to

transform teachers and teacher preparation (Darling-Hammond, 2010b). By the end of the 1980's, each state had standardized requirements for teacher preparation: their own recruitment, program approval, licensing, and professional development policies (Bales, 2006). Teacher certification and licensing policies were different across state lines, so the quality of teachers prepared in one state could not be compared with those prepared in another state (Darling-Hammond, 2000). Yet, the clear absence of a national policy system to address certification, along with measures to hold states accountable for the quality of their teachers, was a national issue, allowing quality and outcomes to vary across states (Bales, 2006).

One response to try and create equity in teacher preparation was the introduction of national funding streams and amendments to elevate practice, alleviate shortages, address more diverse learners in the classroom, and to try and create synergy to align teacher certification with student success (Shulock, 2009; Van de Water & Rainwater, 2001). The Goals 2000: Educate America Act in 1994, and re-authorization of the Elementary and Secondary Education Act in 1994 and 2001, all targeted teacher education through a purposeful coordination of mandated changes to teaching and learning in public-school classrooms (Bales, 2006). The Reauthorization of ESEA in 1994 mandated state implementation of the Goals 2000 systemic reform policies (Bales, 2006). This reform had general focus on teacher education practices in general education settings, with an array of certification issues still remaining in how teachers addressed students from diverse backgrounds and those with disabilities (Ladson-Billings, 1999; Darling-Hammond, 2016; Bales, 2006). Preservice professional programs went from an emphasis on credit collection in subject areas to an emphasis on preparing teachers to teach the content expected of students, and in-service professional development opportunities supported

instructional staff in developing and refining content knowledge and pedagogical approaches (Floden, Robert, Goertz, Margaret, & O'Day, 1995). The national mandate went as far as requiring teachers to be highly qualified. A highly qualified educator was defined as a teacher with a bachelor's degree, full state certification or licensure, and proof of subject-area knowledge through subject area examinations (Darling-Hammond & Youngs, 2002).

In 2015, The Every Student Succeeds Act (ESSA; 2015) advanced equity by upholding critical protections for America's students considered disadvantaged and high-needs and pushed further for teacher performance tied to student learning outcomes. The ESSA maintains an expectation of teacher accountability and action being taken to affect positive change in the lowest-performing schools, where groups of students are not making progress, and where graduation rates are low over extended periods of time. The shift towards making positive change created a need to educate teachers on how to more effectively teach and reach students in the lowest-performing schools (Zeichner, 2009; Darling-Hammond, 2015). In an effort to reduce the federal role in defining and measuring teacher accountability, the term "highly qualified teacher" was eliminated in ESSA, IDEA, and the Higher Education Act (HEA) (Shepherd, Fowler, McCormick, Wilson, & Morgan, 2016). The elimination of the term means teacher quality is defined through state certification, including alternate routes as defined previously under "highly qualified" in NCLB (Shepherd et al., 2016). This change was meant to help with retention and recruitment in high-need areas, but the pressure related to student learning outcomes was not removed from teachers (Cochran-Smith & Lytle, 2006; Darling-Hammond & Berry, 2006; Ravitch, 2016).

Despite all of the legislative reform efforts in education, special education, and teacher preparation, gaps in teacher education outcomes have persisted as have the pressure of being a new teacher, especially serving students in inclusive and low SES environments (Day & Hong, 2016). The issues of stress and burnout are not new phenomena in high needs' settings (Kyriacou, & Sutcliffe, 1978; Kyriacou, 2001; Maslach, Schaufeli, & Leiter, 2001; Hughes, 2001), but the attempt to address this issue is currently at the forefront in both state initiatives and teacher preparation (Sutcher et al., 2016; Carver-Thomas & Darling-Hammond, 2017; Podolsky et al., 2017; Ryan, Nathaniel, Pendergast, Saeki, Segool, & Schwing, 2017). In teacher education, a division appears to exist between focusing teacher roles and measuring accountability (Darling-Hammond, 2000; Darling- Hammond, 2007; Ingersoll, 2009). Although the challenge to retain highly competent teachers affects all schools, the shortage is critical in schools serving students from low SES backgrounds, which historically suffer from a severe shortage of qualified and licensed teachers (Carver-Thomas & Darling-Hammond, 2017; Darling-Hammond, 1999; Ingersoll, 1995; Quartz & Group, 2003). These schools often have high turnover rates and commonly employ a disproportionately large proportion of novice teachers, who, on average, are shown to be less effective than those with more experience (Clotfelter, Ladd, & Vigdor, 2005; Grissom, 2011; Rivkin, Hanushek, & Kain, 2005; Sutcher, Darling-Hammond, & Carver-Thomas, 2016). Hence, the cycle of low educational outcomes is closely paired with high levels of turnover and stress, creating an overall dismal outcome for both teachers and students alike (Barnes, Crowe, & Schaefer, 2007; Sutcher et al., 2016; Podolsky et al., 2017). Both district practices and teacher preparation programs have tried to break this cycle. The issues and gaps in teacher education and preparation have created a historic

pattern of difficulty within federal education programs, in which students who are low-income, disabled, language minority, or any other vulnerable population are taught by the least qualified teachers and untrained aides, rather than the skilled practitioners envisioned by the Elementary and Secondary Education Act and other national laws (Darling-Hammond & Sykes, 2003). These new teachers are considered novices, who often have a heightened sense of purpose for teaching, but typically a limited toolkit to deal with the unique challenges found in high-need environments (Ladson-Billings, 2006).

Yet, some would say teacher preparation has failed to educate teachers to teach students with diverse needs effectively (Warren, 1985). Most teachers in preservice preparation get little to no preparation or actual experience working in diverse settings prior to their first job (Ladson-Billings, 1995). Reviews of the literature on multicultural teacher education (Grant & Secada, 1990; Ladson-Billings, 1995; Zeichner, 1992; Ladson-Billings, 2006; Sutcher et al., 2016; Podolsky et al., 2017) indicate that teacher preparation programs emphasize methodological practices while teacher education students grow increasingly isolated from the conditions of teaching and the experience of teachers (Ladson-Billings, 2006). Teacher educators who bring issues of diversity to the forefront during preparation programs in the past were subject to resistance and harsh criticism from colleagues (Ahlquist, 1991; Tatum, 1994). Today, most states have standards focused on diversity. The Council for Exceptional Children has developed and published a set of high-leverage practices (HLPs) for special educators and teacher candidates. Standards include collaboration, assessment, Social/Emotional/Behavioral, and instruction, including diversity and leveraging student learning across different content areas, grade levels, and student abilities and disabilities (McLeskey et al., 2017). The Council for Accreditation of

Educator Preparation (CAEP, 2016) consists of five standards that define quality in terms of organizational performance and serve as the guidelines for accreditation reviews and judgments. Diversity should be experienced in clinical settings, with candidates, and throughout the preparation program (CAEP, 2016). If training is not grounded in actual practice, teachers will face stress stemming from insufficient preparation.

Novice Teacher Stress in High-Needs Schools

How do teacher preparation programs better prepare novice teachers for the stress of teaching in general? How are novice teachers supported to address the stress they encounter in general, but specifically, in more inclusive high-needs schools? The literature is filled with many ideas and programs, but actual action that can be taken by the novice teacher to help him or herself is just starting to emerge (Frank, Reibel, Broderick, Cantrell, & Metz, 2015; Harris, Jennings, Katz, Abenavoli, & Greenberg, 2016; Jennings, & DeMauro, 2017; Larson, Cook, Fiat, & Lyon, 2018). Researchers typically define novice teachers as someone within the first five years of teaching, who has completed pre-service training or preparation programs (National Center for Education Statistics, 2015). Novice teachers, in general, note they do not feel adequately prepared for the challenges of the first years in the classroom. Specifically, poor classroom management has been noted by novices as the number one issue leading to higher levels of stress and burnout and lower effectiveness during instruction (Jacob et al., 2012).

A range of practices and theories are provided to support novice teachers, with the majority focused on additional training or mentor/leadership support. For example, Hodge, Jupp, and Taylor (1994) recommended novice teachers be provided with guidance and counseling

support, opportunities for skill-sharing, and lifelong learning opportunities in practical stress reduction strategies (e.g. relaxation and classroom and time management). Perda (2013) found more than 41% of novice teachers left the profession within five years of entry, noting behavior management as a concern causing stress and anxiety.

One program research has supported as positive and an avenue to relieve stress for novice teachers is mentoring and induction programs to reduce burnout and increase retention (Holloway, 2001; Smith & Ingersoll, 2004; Wilson, Darling-Hammond, & Berry, 2001). Mentoring is the action a person takes to provide support and assistance to another (Prilleltensky, Neff, & Bessell, 2016), which should not be confused with randomly grouping more experienced teachers and novice teachers without guidance, formal objectives, or orientations (McCann, Johannessen, & Ricca, 2005; Prilleltensky, Neff, & Bessell, 2016). Mentorship for novice teachers in high needs schools includes several levels of support, such as mentorship from the same field, teacher collaboration, external network involvement, beginners' seminars, teachers' aides, and supportive communication with administrators (Smith & Ingersoll, 2004; Ingersoll, & Strong, 2011; Guha, Hyler, & Darling-Hammond, 2017).

Novice teachers have also noted classroom management and student discipline as a major stressor during their first years of teaching (Bondy, Ross, Gallingane, & Hambacher, 2007; Robertson, 2008; Ross, Romer, & Horner, 2012; Dicke, Elling, Schmeck, & Leutner, 2015; Ouellette, Frazier, Shernoff, Cappella, Mehta, Maríñez-Lora, & ... Atkins, 2017), due to lack of hands-on classroom experiences, understanding academic tasks, and behavior management (Dicke, Elling, Schmek, & Leutner, 2015; Kagan, 1992). Researchers have shown that the lack of exposure and inexperience in the classroom could be combatted with professional

development to help reduce teachers' stress and allow teachers to feel more competent (Bergeron, 2008; Dicke et al., 2015; Prilleltensky, Neff, & Bessell, 2016). In order for professional development to be valuable, the focus should be on specific skills and techniques novice teachers need to improve (Kennedy, 2016).

The goal of these programs is to alleviate stress and burnout while enhancing teacher well-being, not only by reducing risk factors, but by also increasing awareness and providing a toolkit of strategies to combat these issues for novice teachers in their classrooms (Prilleltensky et al., 2016). Novice teachers need to be aware of how to use effective practices (e.g. behavior management and mindfulness-based stress reduction strategies) for both problem-solving and psychological well-being in classroom instruction (Hartney, 2008; Herman & Reinke, 2015).

Teacher Burnout in Relation to Serving More Diverse Populations

The primary goal of providing support to novices in the program mentioned were to alleviate stress and burnout. Since the 1980's, teacher burnout and stress has been documented, following a push for higher accountability and access for all learners (Farber, 1982). The National Education Association (NEA) convention in 1979 determined teacher burnout as the central theme, and teacher trainers reported burnout was often the highest rated subject on needs assessment measures designed to identify major teacher concerns (Farber, 1982). Despite acknowledging the increase in burnout rates, pressure did not decrease on teachers. Instead, a sharp increase was observed from the mid 1980's onward. After *A Nation at Risk* was published in 1983, reports emerged from national commissions focused on higher accountability for teacher outputs, aligned with student learning. From this report, studies were conducted on low

teacher quality, troubling gaps in achievement based on minority status, and the overall erosion of US public schools (National Center for Education Statistics, 2005). Studies showed teacher burnout was connected to prolonged teacher stress, caused by challenging work conditions in urban schools, including overcrowding, using limited resources, physical deterioration (Atkins, Graczyk, Frazier, & Abdul-Adil, 2003; Boyd & Shouse, 1997; Cappella, Frazier, Atkins, Schoenwald, & Glisson, 2008; Shernoff, Mehta, Atkins, Torf, & Spencer, 2011) being burdened by policies that emphasized test scores, and teaching high numbers of students with complex learning and mental health needs (Kataoka, Zhang, & Wells, 2002; Langley, Nadeem, Kataoka, Stein, & Jaycox, 2010; Shernoff et al., 2011; Smylie, 1999). This juxtaposition in the field between expecting more and more of teachers and at the same time, blaming and holding them accountable for student learning outcomes, increased tension, and in some areas such as special education and high need districts, is consistently one of the causes of teacher shortages (Barnes et al., 2007; Sutcheret et al., 2016; Podolsky et al., 2017). The individual teacher's stress also is noted to directly impact classroom climate and the quality of relationships with administrators, parents, and most importantly, students. Both classroom climate and quality of relationships are considered core resources for effective teaching and student learning (Hamre & Pianta, 2005). Yet, researchers have shown teachers experiencing high rates of occupational stress are more likely to criticize their students, lose their temper, and resort to punitive discipline strategies when compared with teachers experiencing lower stress (Yoon, 2002). Stress also impacts teachers' ability to deliver instruction effectively, which has implications for student learning and achievement (Ransford, Greenberg, Domitrovich, Small, & Jacobson, 2009; Shernoff et al., 2011). The landmark of teacher practice since the 1980's has been to increase expectations,

broaden the range of learners in the classroom, and hold teachers individually accountable for any lack of student progress (Darling- Hammond, 1996).

This combination of stressors has taken its toll on teachers (Barnes et al., 2007; Podolsky et al., 2017). Stress, a psychological demand, can be defined as the problematic outcomes referred to as the cause of emotional distress, known as anxiety, depression, and psychosomatic complaints (Day, 1998). Evidence is provided by Day and Hong (2016) to show teaching is stressful, and emotions play a key part in the process of building and sustaining resilience in educators. The effects of emotional labor, associated with teaching in high-needs schools, can become the catalyst of strain, anxiety, disappointment; and having an impact on the commitment, satisfaction, and self-esteem of teachers (Day & Hong, 2016; Isenbarger & Zembylas, 2006). Teacher stress and burnout consists of mostly unidirectional models of progression: the emergence of stress, the emergence of stress-induced experiences, and the emergence of reactions to the stress-induced experiences (Friedman, 2000). This cumulative effect of stress is one of the reasons cited for high turnover rates of teachers (Barnes et al., 2007; Sutcher et al., 2016; Podolsky et al., 2017).

Today, national estimates suggest that between 19% and 30% of teachers leave the profession within the first five years, with higher turnover (up to 55%) in urban, high needs (eligible for Title 1 support) schools, noting stress as the primary reason (Barnes et al., 2007; Podolsky et al., 2017). Teacher burnout, and, in turn, attrition, impacts the levels of stress on both the teachers and the students, showing effects on classroom climate and student achievement (Hughes, 2001). Burnout can be defined as exhaustion, tendency to depersonalize others, and lowered self-esteem (Gelder, Gath, & Mayou, 1989; Hodge, Jupp, & Taylor, 1994).

A recent study sponsored by the Carnegie Foundation for the Advancement of Teaching cited the most frequently reported reasons teachers left the profession included lack of professional development, poor feedback, disconnectedness between colleagues, and inadequate sources of emotional support (Headden, 2014).

The standard procedure for assessing teachers' stress, burnout, and anxiety has been through survey research and qualitative research. Seidman and Zager (1991) noted several positive stress reduction approaches used by teachers and found that competitive or low level physical exercise, meditation, relaxation, hobbies, and vacation activities all are correlated with lower rates of burnout. The authors also reported daily workload stress reduction strategies, correlated with decreased emotional exhaustion and depersonalization and increased personal accomplishment, were found to reduce stress. Boyle, Borg, Falzon, and Baglioni (1995) evaluated the dimensions of teacher stress using a principle components analysis, which determined workload and student misbehavior were the two major contributors to stress.

Reviews of literature on stress management techniques have noted that biofeedback is helpful in reducing stress in various professions (Burish, & Jenkins, 1992; Ratanasiripong, Ratanasiripong, & Kathalae, 2012; Klich, 2016). Biofeedback involves the voluntary control of physiological mechanisms such as breathing rate, and benefits include reduced anxiety, tension, and stress related to hypertension. Raising a teacher's awareness of the issue of stress and burnout, specifically for novice educators in high-needs inclusive classrooms, seems an important next step in combating burnout (Friedman, 2000).

Immediate Biofeedback to Reduce Stress

Biofeedback could be a helpful tool to support novice teachers by creating awareness of tension and stress-related breathing rates to increase self-awareness and decrease stress (Sparks, 1983; Friedman, 2000). The term biofeedback was officially defined at the first meeting of the Biofeedback Research Society in 1969 as any technique using instrumentation to give a person immediate and continuing signals in changes in a bodily function that one is not usually conscious of, such as fluctuating blood pressure, brain wave activity, or muscle tension. The individual is then able to use the information to learn how to control these functions, which were in the past automatic and involuntary (Schwartz, 2010; Stein, 2001). The updated definition of biofeedback, approved in 2008 by the Association for Applied Psychophysiology and Biofeedback (AAPB), Biofeedback Certification International Alliance (BCIA), and International Society for Neurofeedback and Research (ISNR), is the process allowing an individual to learn how to change physiological activity for the purposes of improving health and performance (Schwartz, 2010). Specific instruments measure the physiological activity such as brainwaves, breathing, heart function, muscle activity, and skin temperature. These instruments provide immediate and accurate feedback to the user. The presentation of feedback information in conjunction with changes in thinking, emotions, and behaviors can support desired physiological changes. Over time, the changes can endure without continued use of an instrument (Schwartz & Andrasik, 2017).

Paced, deep rhythmic calm breathing is an effective technique to reduce tension and stress, but several limitations exist to creating a successful rhythmic pattern (Benson & Stuart, 1993). Without proper assessment, there is no personal way to guarantee

breathing is being done correctly. Biofeedback tools can measure autonomic breathing patterns, providing direct feedback through a haptic signal nature did not build into the human system. The sending of this signal provides an opportunity for the recipient to learn through self-correction, and eventually, alteration of physiological state, in real time, to help a person change or control a targeted behavior (Reiner, 2008; Schwartz, 2010; Schwartz & Andrasik, 2017). Feedback about breathing rates can strengthen awareness of someone's breathing to become more effective at work and in life (Spire, 2016). Biofeedback on breathing rates could potentially be integrated into classrooms for novice teachers to reduce stress and burnout. Novice teacher workload stress has a very detrimental effect (Kyriacou & Sutcliffe, 1978; Russell, Altmaier, & Van Velzen, 1987; Pithers, 1995; Kyriacou, 2001; Johnson, Cooper, Cartwright, Donald, Taylor, & Millet, 2005). It can produce depression, anxiety, absenteeism, vulnerability to work injuries, and job burnout, which not only affects the teacher, but also the students in the classroom (Kyriacou & Sutcliffe, 1978; Kyriacou, 2001; Maslach, Schaufeli, & Leiter, 2001; Hughes, 2001). Reiner (2008) found portable and low-cost, biofeedback devices are more helpful than other relaxation techniques like yoga, meditation, and other unassisted breathing techniques.

In early work, Wenck, Leu, and D'Amato (1996) explored the reduction of anxiety with children using a combination of electromyography and thermal biofeedback techniques**.** Participants in the biofeedback intervention groups received six sessions of thermal training and six sessions of electromyography training over a six-week period. A post-test anxiety scale demonstrated a significant reduction in both state and trait anxiety. These researchers suggested biofeedback as a viable intervention, which might be coordinated and provided by psychologists to reduce anxiety in children. Biofeedback interventions could be used as a component of

outcome or standards-based education, due to being behavioral, measurable, practical, and showing signs to positively influence academic achievement.

Calderon and Thompson in 2004 expanded the concept and use of biofeedback being simply numerical information to a more holistic model of relaxation training in a review of literature focused on public health professionals. The concept of their work was to approach biofeedback more holistically in an attempt to decrease stress-related illnesses. Calderon and Thompson (2004) concluded that specific courses on self-regulation methods of guided imagery, biofeedback, and relaxation followed by sustained PD in these targeted areas were effective in reducing stress and should be further researched.

Consolo, Fusner, and Staib (2008), conducted a study using two surveys, one to measure student stress from life experiences and one to measure vulnerability to stress, and then introduced diaphragmatic breathing as a simple stress reduction technique. Diaphragmatic breathing was taught to students as a way to gain control over anxiety prior to examinations. The objective was to compare student heart rates and performance on cognitive examinations and clinical laboratory practicum examinations, before and after, using diaphragmatic breathing to reduce heart rate and improve examination performance. In comparing test scores and heart rates after deep breathing relaxation, the researchers found the results were inconsistent. The researchers suggest future investigations should examine the impact of a stress reduction program on the incidence of stress-related symptoms.

Kennedy and Pretorius (2008) conducted two pilot studies on integrating a portable biofeedback device for employees working in health maintenance organization (HMO) and behavioral risk management call centers as a way to potentially reduce employee stress. Two

pilot studies took place in two separate call centers. The researchers proposed assessing the impact of a portable heart rate variability (HRV) biofeedback device, StressEraser, which provided employees with a visual indicator of their positive rates of breathing (4.5 to 7.5 breaths per minute) and awarded a point for each time they reached a smooth rate of breathing over a 20-minute period each day, with a goal of a 100 points. The researchers found, from the first pilot study, participants significantly improved their call scores $F(334)=10.85$, $p < .01$ as compared to the control group, in customer ratings of quality of services (both helpfulness and overall interaction scores). The second study used the same biofeedback device, but the level of stress-related complaints over a 21-day period were compared between the experimental and control groups. Two questionnaires were given out at baseline and at the end of the study, which assessed the stress-related symptoms such as gastrointestinal (GI) problems, depression, and burnout while the other instrument examined environmental stressors such as a supportive work environment and resource management. The results from the second pilot study revealed a significant decrease in personal stressors over the course of the study, $F(16)=6.06$, $p < .001$, but no significant changes in environmental stressors, $F(15)=1.16$, $p > 1$. The largest effects on the personal stressors scale were found for reductions in burnout ($t(14)=4.18$, $p < .001$), fatigue ($t(14)=4.14$, $p < .001$), GI problems ($t(14)=4.39$, $p < .001$), and headaches ($t(14)=5.08$, $p<.0001$) in the experimental group.

The use of biofeedback continued to evolve in use, within and across disciplines, with an expansion in the fields of sports and physical activity (Coakley, 1992; Wilson, Peper, & Moss, 2006; Morgan & Mora, 2017). Todd in 2011 completed a composite of multiple case studies to create a summary on the research in the field of sports finding the emergence of a

multidisciplinary approach being used to improve athletic performance and overall life functioning. Collectively, the cases examined in track and field used heart rate/respiration biofeedback and QEEG-guided neurofeedback to improve performance and reduce stress. Todd found, from the composite of these case studies, that applying cognitive and behavioral psychology, biofeedback, and neurofeedback to high-achieving 18–24 year-old athletes not only improved their athletic performance, but the athlete's perceived quality of life.

Perry, Shaw, and Zaichkowsky (2011) also evaluated the efficacy of biofeedback with athletes. They used different training protocols to teach cognitive and emotional self-regulation to improve athletic performance on sport-specific tasks using the FlexComp Infiniti biofeedback system. This system collects respiration, skin conductance, heart rate (HR), and electroencephalography (EEG) data. Following the biofeedback intervention on 15 athletes (4 in ice hockey and 11 in gymnastics), the researchers found improved cognitive and emotional self-regulation and increased athletic performance on sport-specific tasks. The researchers concluded a full mind–body recovery of both cognitive and emotional self-regulation was helpful in successful performance of these athletes. Perry and colleagues encouraged further mind-body recovery types of research be conducted.

Other fields also continued to build upon the research in the use of biofeedback. Lemaire, Wallace, LeWin, De Grood, and Schaefer (2011) conducted a randomized controlled trial measuring efficacy of a stress-reduction intervention to determine whether a biofeedback-based stress management tool, consisting of rhythmic breathing, actively self-generated positive emotions; and if a portable biofeedback device reduces physician stress in an urban tertiary care hospital. The objective of the study was to compare student heart rates and performance on

cognitive examinations and clinical laboratory practicum examinations, before and after, using diaphragmatic breathing to reduce heart rate and improve examination performance. The researchers found that a biofeedback-based stress management tool was a simple and effective stress-reduction strategy for physicians.

Ratanasiripong et al. (2012) conducted a randomized controlled study with a new generation of portable biofeedback equipment to help address nursing students' stress and anxiety. Results indicated the biofeedback group was able to maintain the same level of stress over the five-week period, even though they experienced more stressors and demands in their new clinical training site. The control group had a significant increase in recorded stress levels over the five-week period of clinical training at the same site. Additionally, the biofeedback group had a significant reduction in anxiety, while the control group had a moderate increase in anxiety. The better the nursing students managed stress and anxiety, the more successful they were in their clinical training. Ultimately, the more psychologically healthy the nursing students were, the more they flourished and graduated to become productive and contributing members of the nursing profession.

The productivity of the overall workforce was measured in another study in 2017 by Moraveji, Santoro, Smith, Kane, Crum, and Susi. These researchers conducted a study with Stanford University, Spire, Inc., and LinkedIn Corp's Employee Wellness Team using a subset of LinkedIn's U.S. workforce. This entire subset of employees (N=225) were administered three psychological rating instruments on stress, mood/anxiety, and overall affect. The experimental group of 114 employees were given the Spire, a biofeedback health monitoring device that vibrates when the person wearing the device shows patterns of stress (e.g., erratic breathing,

elevated pulse rate), compared to 111-employees who did not receive the Spire. The goal of this study was to show the potential of using passive sensing, real-time haptic feedback, mobile notifications, and breathing training to improve stress reactivity amongst workers to see if this type of biofeedback improved mental health and productivity. Compared to the control group, the Spire group experienced a 10% decrease on the Perceived Stress Scale ($p<0.05$), a 12% decrease in stress symptoms on the Mood and Anxiety Symptom Questionnaire ($p=0.001$), and an 11% decrease in negative affect on the Positive and Negative Affect Schedule ($p=0.005$). Using the Spire led to 2.5 (27%) fewer anxious days and 3.5 (35%) more energetic days, compared to the control group, over a 30 day period of time. Although not statistically significant, physiological measures supported these results, showing the use of Spire led to 37% (median 28%) more calm- and 25% (median 8%) more focus-related breathing patterns. The use of the Spire also led to 15% (median 7%) more tension-related breathing patterns attributed to the learning curve associated with any new technology (Moraveji et al., 2017). Results show that the intervention significantly reduced negative stress and anxiety symptoms as well as provided an encouraging impact on productivity-related measures. Both findings were corroborated by physiological measures. The researchers also noted the positive potential of the use of a wearable biofeedback health tracker as a scalable means of improving stress rates among workers in a more personalized and private way for improved health, wellbeing, and productivity (Moraveji et al., 2017).

Biofeedback as a Tool for Reducing Teacher Stress and Burnout

The stress teachers feel from work is dangerous (Kyriacou & Sutcliffe, 1978; Russell, Altmaier, & Van Velzen, 1987; Pithers, 1995; Kyriacou, 2001; Johnson, Cooper, Cartwright, Donald, Taylor, & Millet, 2005). The situations teachers endure at work are noted to produce depression, anxiety, absenteeism, vulnerability to work injuries, and job burnout, which not only affects the teacher but also the students in the classroom (Kyriacou & Sutcliffe, 1978; Kyriacou, 2001; Maslach et al., 2001; Hughes, 2001). Stress impacts teachers' ability to deliver instruction effectively, which has implications for student learning and achievement (Ransford, Greenberg, Domitrovich, Small, & Jacobson, 2009; Shernoff et al., 2011). Teachers who are more aware of their stressors are more likely to emphasize positive student behavior and respond supportively to students' negative emotions (Li-Grining, Raver, Champion, Sardin, Metzger, & Jones, 2010; Swartz & McElwain, 2012). Teachers' everyday interactions with students, interactions with colleagues, IEP meetings, school-wide meetings, classroom management, reactions to student behavior, and ability to implement curriculum are all impacted by stress (Mashburn, Hamre, Downer, & Pianta, 2006; Hamre, Pianta, Downer, & Mashburn, 2008; McLean & Connor, 2015).

Stressed out teachers can often lead to stressed classroom environments (Marzano, Marzano, & Pickering, 2003). Teachers are pivotal figures in the development of students' social, emotional, and academic achievement. Teachers who have high social and emotional competence develop a classroom setting more supportive of individual student growth as well as the collective classroom (Jennings & Greenberg, 2009). Research suggests mindfulness training for teachers can change the bidirectional teacher to student interactions, such as student

compliance when the teacher gives positive praise (Singh, Lancioni, Winton, Karazsia, & Singh, 2013). Mindfulness practices improve an individuals' ability to foster self-regulation and adaptability to emotionally-laden situations (Davidson et al., 2003), a vital skill set for teachers. For example, mindfulness researchers have demonstrated effectiveness in decreasing negative physical and emotional experiences such as anxiety and stress (Call, Miron, & Orcutt, 2014), depression (Hofmann, Sawyer, Witt, & Oh, 2010), and chronic pain (Kabat-Zinn, 1982). Research has also shown that mindfulness-based practices lead to increases in positivity, such as self-compassion (Neff, 2003), acceptance of distressing emotions (Hayes, Luoma, Bond, Masuda, & Lillis, 2006), and social connection (Meiklejohn et al., 2012).

The work of Murphy (1996), Schafer (1997), and Stein and Cutler (1998) identified useful methods of relaxation; prescriptive exercises; biofeedback; social skills training; and self-talk strategies to combat symptoms of stress. Focusing on biofeedback, the use of wearable technology influenced by mindfulness-based strategies, like the Spire Inc. which detects breathing rates, with novice teachers in low SES elementary schools, could be used to reduce stress. Based on a teacher's breathing rate, the Spire Inc. provides biofeedback of haptic vibration and multiple mindfulness-based strategies to combat the symptoms of stress throughout the day.

The promise of mindfulness training is the production of transformational change in the teacher, which in turn impacts student behavior and reduces stress in the classroom. According to Buddhist ontology, the arising of teacher and student behaviors is interdependent (Singh et al., 2013); thus, if the teacher changes behavior through mindfulness-based strategies with the intention of helping the students, the effects of these changes should be evident in classroom

behaviors. Effective classroom management is a nonintrusive way for novice teachers to reinforce the specific, desired behaviors of students. Behavior-specific praise gives students specific, positive verbal feedback indicating approval of social or academic behavior (Conroy, Sutherland, Snyder, Al-Hendawi, & Vo, 2009). When novice teachers master effective praise, it can then be considered as a generalized reinforcer to help foster children's intrinsic motivation to learn and reduce novice teacher stress and anxiety (Brophy, 1981; Conroy et al., 2009; Hitz & Driscoll, 1988). The more structure and personal awareness of breathing a novice teacher has in the classroom, the easier it is for the teacher to focus on student learning rather than on teacher performance, which, in turn, further reduces anxiety and stress (Dewey, 1916; Lester & Onore, 1990; McNeil, 1982).

What is needed is a tool that is not doing something to, but with, and for, novice teachers (Friedman, 2000; Singh et al., 2013; Schwartz & Andrasik, 2017; Hartney, 2008; Herman & Reinke, 2015). Many of the strategies suggested are adding more on the teachers' plate, such as professional development, instead of less stress and more self- centeredness to reduce stress (Prilleltensky, Neff, & Bessell, 2016). The purpose of this study was to build upon this literature base on legislative shifts, changes in the classroom demographics, and report results of high teacher stress and burnout to potentially decrease these issues for novice teachers. Reducing novice teachers' stress, could lead to more confidence in their ability to manage the classroom, complete workload requirements (e.g. paperwork and meetings), and reduce burnout. Given the effectiveness of biofeedback in other fields (Ratanasiripong et al., 2012) and the potential utility of breathing awareness, the mindfulness-based practice of biofeedback on breathing could decrease the stress and anxiety of novice educators (Reiner, 2008; Schwartz, 2010; Schwartz &

Andrasik, 2017). The researcher examined the effect of using the biofeedback tool, the Spire, on novice teachers' (1-5 years' experience) breathing patterns in low SES, inclusive elementary classroom environments. How the use of this tool relates to teachers' pretest and posttest scores on the Teacher Stress Inventory and perceived burnout levels based on the Maslach Burnout Inventory-Educator Survey provided exploratory information on the effectiveness of using biofeedback to support novice, inclusive teachers in classrooms with students from low SES backgrounds.

CHAPTER THREE: METHODS

Purpose of the Study

Biofeedback is identified as a helpful tool to combat stress in various professions (Beehr & Newman, 1978; Shapiro, Shapiro, & Schwartz, 2000). Biofeedback involves the voluntary control of physiological mechanisms such as breathing rate. Reported benefits include reduced anxiety, tension, and stress-related hypertension. The level of anxiety, tension, and stress found in today's novice teachers is reportedly high and is suspected to be an issue aligned with a lack of retention in the workforce (Kyriacou, 2001; Skaalvik & Skaalvik, 2016). One potential way to address this issue of overall stress is to consider using biofeedback to raise teachers' awareness of the relationship of breathing patterns to stress and burnout. This study involved looking at the use of biofeedback as a pathway to combat burnout and potentially increase retention for novice educators in high-needs, inclusive classrooms.

The purpose of this study was to explore the effectiveness of a biofeedback tool on the perceived stress and burnout scale of novice teachers in high-needs, inclusive classrooms. The researcher focused specifically on using the Spire to track breathing patterns and to provide biofeedback through a haptic, silent alarm as an intervention to provide awareness to these novice teachers of their tense breathing. By monitoring and alerting teachers of tense breathing, using biofeedback, the teachers could become more aware of what triggers their stress in the classroom (See Figure 3).

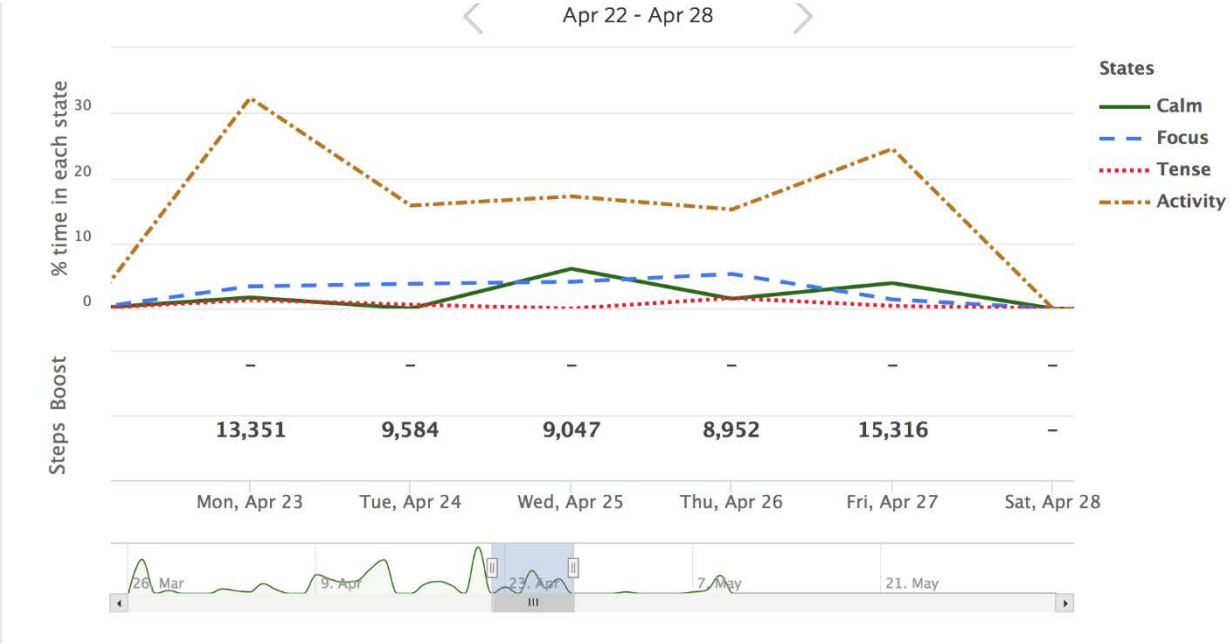


Figure 3: Spire data as viewed by researcher (Spire, 2018).

While mindfulness through biofeedback has been identified as a promising means for reducing stress (Klich, 2015; Bruin, Zwan, & Bogels, 2016), few researchers have investigated the approach of tracking breathing with novice teachers and the impact on stress and burnout towards their professional role. Mindfulness in this study is defined as teachers noticing body sensations, observing thoughts and emotions related to stress, and practicing self-compassion through the use of deep breaths during times of stress (Flook, Goldberg, Pinger, Bonus, & Davidson, 2013). These times of stress are alerted through a small device called the Spire. When haptic data on the Spire shows levels of tense breathing for over two minutes, a slight vibration occurs on the device, and teachers are to take a deep breath to reduce their tense breathing. The teachers also have the option to go to the Spire application, downloaded on their phone, to observe their breathing patterns. The application records tense, calm, focused, breathing patterns as well as active and sedentary behaviors while wearing the device.

Using this tool, the Spire, the following research questions guided the researcher in this quasi-experimental case study of nine teachers. Each teacher was treated as an individual case study in their use of the Spire, aligned with their perceived pre and posttest levels of stress and burnout, measured by the TSI and MBI-ES.

Research Questions

The following research questions were explored in this study:

(1) To what extent does the use of a biofeedback device affect novice teachers' (1-5 years' experience) breathing patterns in inclusive elementary classroom environments, where 50% or more of the population are students from low SES backgrounds?

(2) To what extent does the use of a biofeedback device change perceived stress levels based on the Teacher Stress Inventory pretest and posttest?

(3) To what extent does the use of a biofeedback device change perceived burnout levels based on the Maslach Burnout Inventory pretest and posttest?

(4) Social Validity Question: To what extent do teachers believe the goals, procedures, and outcomes of a biofeedback device, using breathing feedback, is an effective means of reducing stress as discussed during final interviews?

Setting and Participants

The study design employed a quasi-experimental design where each teacher served as his or her own control for pre-post data analysis. This design was selected due to the individual nature of biofeedback and breathing patterns that are unique to each teacher (no single standard

exists for breathing rates as it can vary per individual), with the range of 18-24 breaths per minute for tense breathing (Plarre et al., 2011; Spire, 2018). Therefore, each novice teacher participant's (n = 9) data were analyzed individually as a case, and then a t-test was run of three baseline and three posttest data points to answer research question one. To answer research question one, a simple average of breaths that occurred over a 6 hour time series, across three days pre and three days post, also was calculated; and a change score was reported. These averages were not statistically compared, but were simply reported as averages to talk about increases or decreases in breathing patterns for each of the 9 participants.

A total of 9 out of 13 teachers agreed to participate in the study, but only nine teachers completed all components of the study. One teacher did not complete the pretest and decided to withdraw in the first week of the study, and three other teachers decided to no longer wear the Spire; no posttest data were provided, and they missed more than five days of school. Hence, nine individual case studies were completed in this study.

All nine participants in the study were within their first five years of teaching and were working in an inclusive, low SES public charter elementary school (50% or more of the students were on free and reduced lunch) in Florida. An inclusive school was defined as having two or more students with disabilities being educated alongside their nondisabled peers. Teachers were the primary participants; therefore, individual student data were not gathered. The demographics of students from schools are representative of students from the area. All schools included in the study were located in neighborhoods considered as communities of poverty (demographics similar to those found in a Title 1 public school setting). School bus transportation was not offered at these sites, so students predominately walked or rode bikes to school. Families also

used public transportation to bring their children to school. Schools involved served predominantly low income and racial or ethnic minority populations, and all schools, as part of their mission, served a higher than average disability population (approximately 50% at each site).

School One

School One was a public charter elementary school that served 165 students and employed 14 teachers. At the time of the study, the ratio of students to adults was 6:1. Due to the inclusive nature of the school, the typical structure of each classroom included one teacher leading the class and at least one teaching assistant or aide providing individual or small group support to students with extensive support needs. The number of adults in the classroom varied, based on the needs of the students in the class. This school was an inclusive school, serving students from pre-kindergarten to Grade 5, with and without disabilities, together in general education classroom settings. Each grade level faculty team consisted of a general education teacher, a special education teacher, teaching assistants, and teaching aides. Due to the small, inclusive nature of the school, and the low student-to-teacher ratio, some students were grouped into multi-age classes.

Table 2

School One Demographics Information

Participant	Age	Gender	Degree	Certificate	# of Years Taught	# of SWD	# of SWOD	Grade
T1	26	F	B.S. El. Ed. Minor in ESE	K-6 El. Ed./Sp Ed.	3	13	7	2
T2	34	F	B.S. El. Ed.	K-6 El. Ed./Sp Ed.	3	17	4	$4^{th}/5^{th}$

Note. School 1 Poverty: 76%; Total Students: 165; Student-Teacher Ratio: 6:1.

Teacher 1 was in her second year of teaching and held a Bachelor's degree in elementary education. She held teaching certifications in Exceptional Student Education, Elementary Education Grades K-6, and had endorsements in reading and English for Speakers of Other Languages (ESOL). She also had a co- teacher and teaching assistant in the classroom. Teacher 2 was a third year teacher and held a Bachelor's degree in Elementary Education. She held teaching certifications in Exceptional Student Education, Elementary Education Grades K-6, and had endorsements in reading and ESOL. She also had a co-teacher and paraprofessional in her classroom.

School Two

School Two was a public charter elementary school that served approximately 100 students and employed 14 teachers. At the time of the study, the ratio of students to adults was 8:1. Very similar to School One, due to the inclusive nature of the school, the typical structure of each classroom included one teacher leading the class, and at least one teaching assistant or aide providing individual or small group support to students with extensive support needs. The

number of adults in the classroom varied, based on the needs of the students in the class. This school was an inclusive school that personalized education for all learners, serving students from pre-kindergarten to Grade 5, with and without disabilities, together in general education classroom settings. Grades 3-5 were recently added to the school at the beginning of the 2017-2018 school year. Each grade level faculty team consisted of a general education teacher, a special education teacher, teaching assistants, and teaching aides. Due to the small, inclusive nature of the school, and the low student-to-teacher ratio, some of the students were grouped into multi-age classes.

Table 3

School Two Demographics Information

Participant	Age	Gender	Degree	Certificate	# of Years Taught	# of SWD	# of SWOD	Grade
T3	31	F	B.S. Psychology/ M.A. Education specialist- School Psych/ Ed. D. Special Ed	K-6 El. Ed./Special Ed./ School Psych.	4	11	5	3/4/5
T4	54	F	B.S. Elementary Education Minor in ESE	K-6 El. Ed./Birth-four/ Special Ed.	1	11	5	3/4/5
T5	25	F	B.S. Elementary Education Minor in ESE	K-6 El. Ed./Special Ed.	2	12	9	1

Note. School 2 Poverty: 79.5%; Total Students: 100; Student-Teacher Ratio: 8:1.

Teacher 3 was in her fourth year of teaching and held a Doctorate degree in elementary education. She held teaching certifications in Exceptional Student Education, Elementary

Education Grades K-6, and school psychology. She had a co-teacher in her classroom. Teacher 4 was a first year teacher, had a Bachelor's degree in Elementary Education with a Minor in Exceptional Education. She held teaching certifications in Exceptional Student Education, Birth to four years old, Elementary Education Grades K-6, and had endorsements in reading and ESOL. She had a paraprofessional and an assistant in her classroom. Teacher 5 was in her fourth year of teaching and holds a Bachelor's degree in Elementary Education with a Minor in Exceptional Education and is also the team lead at her school. She held teaching certifications in Exceptional Student Education, Elementary Education Grades K-6, and had endorsements in reading and English for Speakers of Other Languages (ESOL). She had a paraprofessional and teaching assistant in her classroom.

School Three

School Three was a public charter elementary school that served approximately 285 students and employed approximately 20 teachers. At the time of the study, the ratio of students to adults was 7:1. The school had a commitment to differentiate instruction to allow all students to develop to their fullest potential and was a completely inclusive setting. Due to the inclusive nature of the school, the typical structure of each classroom included one teacher leading the class, and at least one teaching assistant or aide providing individual or small group support to students with extensive support needs. The number of adults in the classroom varied, based on the needs of the students in the class. This school was an inclusive school, which personalized education for all learners, serving students from infants to Grade 5, with and without disabilities, together in general education classroom settings. Each grade level faculty team consisted of a

general education teacher, a special education teacher, teaching assistants and teaching aides. Due to the small, inclusive nature of the school, and the low student-to-teacher ratio, some of the students were grouped into multi-age classes.

Table 4

School Three Demographics Information

Participant	Age	Gender	Degree	Certificate	# of Years Taught	# of SWD	# of SWOD	Grade
T6	28	F	B.S. Rehab services	Temp Teaching Cert./Special Ed.	2	9	0	2/3
T7	27	F	M.S. in Exceptional Education	PreK-3 El. Ed./Special Ed.	4	9	0	3

Note. School 3 Poverty: 72.6%; Total Students: 285; Student-Teacher Ratio: 7:1.

Teacher 6 was also in her second year as a teacher and held a Bachelor's degree in Rehabilitation Services. She held a temporary teaching certificate and a certificate in Exceptional Student Education. She also had two teaching assistants in her classroom. Teacher 7 was in her fifth year as a teacher and holds a Bachelor's degree in Early Childhood Education and a Master's degree in Exceptional Education. She held teaching certifications in Exceptional Student Education, Early Childhood Education, Elementary Education Grades K-6, and had endorsements in reading, Autism Spectrum Disorder, Sever/Profound disabilities and ESOL. She had two assistants in her classroom.

School Four

School Four was a public charter elementary school that served approximately 272 students and employed approximately 20 teachers. At the time of the study, the ratio of students

to adults was 9:1. The school had a commitment to differentiate instruction to allow all students to develop to their fullest potential and was a completely inclusive setting. The typical structure of each classroom included one teacher leading the class, and at least one teaching assistant or aide providing individual or small group support to students with extensive support needs. The number of adults in the classroom varied, based on the needs of the students in the class. This school was an inclusive school which personalized education for all learners, serving students from infants to Grade 5, with and without disabilities, together in general education classroom settings. Each grade level faculty team consisted of a general education teacher, a special education teacher, teaching assistants and teaching aides. Due to the small, inclusive nature of the school, and the low student-to-teacher ratio, some of the students were grouped into multi-age classes.

Table 5

School Four Demographics Information

Participant	Age	Gender	Degree	Certificate	# of Years Taught	# of SWD	# of SWOD	Grade
T8	29	F	B.S. Early Childhood	PreK-3 El. Ed./Special Ed.	2.5	AM-13 PM-12	AM- 5 PM-3	K/1
T9	43	F	B.S. Leadership	K-6 El. Ed./Special Ed.	1	19	3	2/3

Note. School 4 Poverty: 40%; Total Students: 272; Student-Teacher Ratio: 9:1.

Teacher 8 was in her second year of teaching and held a Bachelor's degree in elementary education. She held teaching certifications in Exceptional Student Education, Elementary Education Grades K-6, and had endorsements in reading and English for Speakers of Other Languages (ESOL). She had a co-teacher and paraprofessional in her classroom. Teacher 9 was in her first year as a teacher and held a Bachelor's degree in Early Childhood Education. She

held teaching certifications in Exceptional Student Education, Early Childhood Education, Elementary Education Grades K-6, and had endorsements in reading and ESOL. She had a co-teacher and assistant in her classroom.

Measures

To assess stress and burnout levels, the following instruments were administered pre-post to each of the participants using The Teacher Stress Inventory (TSI; Fimian, 1988) and the Maslach Burnout Inventory (MBI), Second Edition—Educators Survey Version (Christina Maslach & Jackson, 1981). Data also were collected on breathing rates recorded by the Spire, combined with an informal daily rating of stress, and an interview at the conclusion of the study with regard to teachers' perceptions on the use of the Spire and their overall stress and burnout levels.

Spire Inc. Biofeedback Breathing rate**.** Spire Inc., is a wireless tracker worn as a clip on the waistline or chest (See Figure 1). This device measures teachers' breathing, reminds them to take deep breaths, and provides guided programs on the mobile application to assist the user with correct breathing and mindfulness-based stress reduction strategies (Kelling, Pitaro, & Rantala, 2016). The respiratory rate is derived from the contraction and expansion in the torso and diaphragm and is measured by activity and force sensors; specifically, tense breathing is measured as breathing more rapidly (particularly exhalation) and erratically than normal (Plarre et al., 2011; Van Diest, Bradley, Guerra, Van den Bergh, & Lang, 2009; Vlemincx, Taelman, De Peuter, Van Diest, & Van Den Bergh, 2011). Haptic stimulation is utilized, but only as a reminder or alert when breathing becomes tense or stressed, which generally occurs in the range

of 18-24 breaths per minute (Sherwood, 2006). Although there are numerous definitions of stress (e.g., Lazarus & Folkman, 1984), stress is generally considered as the experience of anticipating or encountering adversity in some individual's goal-related efforts (Carver & Connor-Smith, 2010). Historically, the amount (frequency, intensity, and duration) of the external stressors determines whether stress is debilitating (Holmes & Rahe, 1967). Feedback about breathing can strengthen awareness of a person's own breathing to help him or her become more self-aware and effective at work and in life.

Maslach Burnout Inventory**.** The Maslach Burnout Inventory (MBI), or its teacher-specific version known as the Maslach Burnout Inventory-Educators Survey (MBI-ES) (Jackson, Schwab, & Schuler, 1986), is the most widely used research instrument to measure burnout (Maslach, Jackson, & Schwab, 1986). This instrument is used in over 90% of the empirical research studies on burnout (Hastings, Horne, & Mitchell, 2004; Schaufeli & Enzmann, 1998), and has been found to have strong psychometric properties (Maslach, Schaufeli, & Leiter, 2001). Respondents are asked to indicate agreement with statements about job-related feelings, and the only modification in the version of the MBI for educators is that items refer to "students" instead of "recipients" (Maslach, Jackson, & Leiter, 2006). The MBI-ES consists of 22 items and yields scores along three dimensions: emotional exhaustion (EE), depersonalization (DP), and professional accomplishment (PA). Validity and reliability of the MBI—Educators Survey was reviewed, and developers reported Cronbach's alphas range from .88 to .90 for emotional exhaustion, .74 to .76 for depersonalization, and .72 to .76 for personal accomplishment (Lambert, McCarthy, O'Donnell, & Wang, 2009). Frequency of burnout symptoms are measured on a 7-point, fully anchored scale, ranging from 0 to 6. Test-retest reliability shows scores are

stable over time. Time periods of a few weeks, three months, and one year were used for test-retest reliability. Scores range from .60-.82 across short periods up to a month, whereas scores in the year range were lower at 0.54-0.60 (Maslach, Jackson, & Leiter, 2006). This instrument was administered prior to teachers receiving the Spire and 30 days later after wearing the Spire.

Teacher Stress Inventory**.** The TSI (Fimian, 1988) is used to assess occupational stress. The TSI measures 10 factors that comprise the construct of teacher stress and is composed of 49 items. Five factors represent sources of stress, and five represent manifestations of stress. Stress strength is rated on a 5-point Likert-type scale. The total stress score is used to determine where teachers fall on a continuum of more to less stress.

Research to establish content validity of the TSI was assessed using expert opinion over a 5-year period. All items were demonstrated to be relevant; however, the most relevant items were feeling unable to cope and experiencing physical exhaustion (Fimian & Blanton, 1987). Construct validity was assessed using factor analysis, which supported and identified the 10 subscales: time management, work-related stressors, professional distress, discipline and motivation, professional investment, emotional manifestations, fatigue manifestations, cardiovascular manifestations, gastronomical manifestations, and behavioral manifestations (Fimian & Fastenau, 1990). Test-retest reliabilities range from .27 to .99 for the subscales and .78 to .98 for the whole scale, indicating stability for the stress factors across two hours, one day, one week, and two week intervals (Fimian, 1986). Like the MBI-ES, this instrument was administered prior to teachers receiving the Spire and 30 days later after wearing the Spire.

Sociodemographic information. Teachers were asked to provide sociodemographic data at the beginning of the study. They were asked to indicate their gender, age, ethnic background,

years of teaching experience, teaching position (e.g., general classroom teachers, special education teachers), professional license/certification, and school grade level (e.g., first grade, second grade, third grade, etc.).

Daily stress survey**.** Teachers were asked to indicate daily stress levels using a rating scale of 1-4, with one being not very stressed and a four being very stressed, while participating in the study. This data collection was an informal tool to note any unique activities (e.g., sick that day, had an assembly) to further look at individual teachers' patterns across the study. See Appendix C for the stress daily rating scale.

Social Validity Measure

Social validity refers to the extent to which consumers (e.g., teachers, parents, and students) view a given practice as addressing socially significant goals, socially acceptable treatment procedures, and socially important intervention outcomes (Wolf, 1978). Social validity data were collected through daily stress surveys and an informal, final interview was given at the conclusion of the study (Gast & Ledford, 2014). During the last day of the intervention phase, informal interviews took place with the teachers regarding experiences and perceived outcomes from the Spire biofeedback on breathing rates (e.g., Singh et al., 2007, 2010). The interviews focused on a number of issues, including stress and burnout, social interactions, the Spire Inc. application, and increased self-awareness. To maintain reliability in the interview data collected, all participants were asked the same questions, and the interview procedure was explained before the interviews began. See Appendix D for interview questions.

Using a basic interpretive qualitative methodology, interviews were recorded, transcribed, coded, and analyzed (Merriam, 2002). Categories and themes were determined through a constant, comparative method using data from transcribed interviews across the participants (Glaser & Strauss, 1967). The units of data were sorted and grouped, first by regularities and then by irregularities, into tentative categories and subcategories. Following the initial qualitative findings, a secondary analysis occurred. During this member checking process, the researcher presented initial results and asked participants for help and clarification in interpreting the results (Creswell & Clark, 2007).

Design

A quasi-experimental study is the type of evaluation, which aims to determine whether a program or intervention has the intended effect on a study's participants (Dela Cruz, 2014). A quasi-experimental design was used for this study to assess the changes in breathing rates and overall, perceived stress of individual novice teachers by comparing pretest and posttest scores of each participant, from the biofeedback instrument, the Spire. A comparison of breathing rate scores to the scores on the Teacher Stress Inventory and the Maslach Burnout Inventory-Educators Survey was completed to provide an individualized discussion of each participant's patterns, scores, and perceptions.

Quasi-experimental designs are used to test hypotheses about the effects of manipulable treatments but lack the process of random assignment (Shadish & Luellen, 2005). In this study, all teachers used the Spire for three days during instruction, and all teachers, at the end of the study, continued to wear the Spire during instruction for a final comparison measure. They also

provided daily ratings of stress and completed a pre-post assessment using the TSI and the MBI-ES.

Procedures

Permission to access novice teachers for this study was first secured from each school principal. To recruit teachers, letters were given to teachers in the targeted schools. Participants then wore the Spire for three days in order to determine baseline data (See Table 6). The participants were taught how to use the Spire, and the purpose for the use of the device was provided after completion of the study. Pretest scores from the Spire, TSI, and MBI-ES were gathered on day three of the study. All participants received the post-test of the TSI and MBI-ES on day 24 and wore the Spire for final instructional breathing rate data collection without access to the app (posttest). Daily (days 1-24), all participants were asked to complete a stress rating scale.

Table 6 provides a summary of the procedures, each day, for the novice teachers involved in the study, over a 6-week period, for data collection. Days one to three of the study procedures included wearing the Spire during daily instruction, completing the TSI, and completing the MBI- ES. The teachers wore the Spire biofeedback device for three sessions, during instruction, to establish their own individualized baseline breathing rates. On day three, all teachers took the MBI-ES and the TSI, and their median scores gathered from the Spire were computed. The procedures, again, for teachers on Day 26, involved continuing to wear the Spire during instruction without access to the app, providing daily informal ratings on their stress levels, and retaking the MBI-ES and TSI. All scores from the TSI and MBI-ES, all Spire data, and all daily

ratings of stress were documented in an Excel spreadsheet. Any notes listed on the daily rating of stress were also put into a comment section in an Excel spreadsheet.

Table 6

Study timeline

Days	Tasks
1-3	Wear Spire during instruction daily Complete Teacher Stress Inventory Complete Maslach Burnout Inventory-Educators Survey Complete daily stress survey
4-25	Wear Spire during instruction daily Complete daily stress survey
26-29	Wear Spire during instruction but asked not to access any of the apps related to lowering levels of stress Complete Teacher Stress Inventory Complete Maslach Burnout Inventory-Educators Survey Complete daily stress survey
30-31	Informal interview

Data Analysis

The statistical technique used to analyze the quantitative data gathered in this study was a paired sample t-test, for each individual participants' case data obtained from the Spire. For research question one, the researcher examined the biofeedback device's effect on novice teachers' (1-5 years' experience) breathing patterns in inclusive, classroom environments. The researcher performed a paired t-test for each individual teachers' three days of pretest and three days of posttest Spire data. The TSI posed as an investigation of the teachers' perceived stress

levels based on the TSI pretest and posttest scores. Changes in mean scores from pretest to posttest were compared to determine increases or decreases in individual teachers' TSI scores.

The MBI-ES was used as an investigation of the differences between each individual teacher's MBI-ES scores. The areas identified from this instrument included three categories: emotional exhaustion, depersonalization, and professional accomplishment. The author of MBI-ES reports if emotional exhaustion and depersonalization are high, and professional accomplishment is low, then teachers have a higher risk of burnout. Since the MBI-ES provides a scaled score, each participant's composite mean changes, from pre-test to posttest, were calculated for three categories and compared to the average norm score of a national sample of 4,000 teachers. Each teacher's individualized scores were identified to be above or below the norm for each of the three categories.

A theme analysis of overall stress rating data was presented in a chart showing daily ratings and averages over the course of the study. Interview data were coded for themes and presented descriptively. Finally, social validity data were analyzed descriptively.

Validity and Reliability

The researcher allowed for an external check of the process by using a peer reviewer as a research associate (Creswell, 2013). During each pretest and posttest interaction (TSI, MBS, Spire), 25% of the data gathered were evaluated by an additional trained observer to ensure reliability of the coding. This percent exceeds the suggested target of 20% of all data (Hallgren, 2012; Gast & Ledford, 2014).

The research associate served as an external check for inter-rater reliability of the interviews (Creswell, 2103). The peer reviewer was presented with the interview data gathered for 25% of all sessions to gain at least 90% reliability of coded themes, using a point-by-point matching, by the researcher and the research associate. The research associate kept the researcher honest by asking questions on the researcher's methods, meanings, and interpretations, including checks if researcher bias was present in any of the findings (Creswell, 2013; Creswell & Miller, 2000).

Member checking was used as part of the validation for this study. Member checking involves the solicitation of the participants' views for the credibility of the findings derived from the interviews (Creswell, 2013). Once the researcher had a rough draft of the interpretation and findings, she had the participants look at the draft and provide additional observations or interpretations. The equally desirable but different treatment allows the researcher to avoid four threats to internal validity: (a) experimental treatment diffusion, (b) compensatory rivalry by the control group, (c) compensatory equalization of treatments, and (d) resentful demoralization of the control group (Gall, Gall, & Borg, 2007; Shadish, Cook, & Campbell, 2002).

CHAPTER FOUR: RESULTS

Introduction

The purpose of this multiple case study design was to determine if the use of the Spire, a biofeedback device, changed the breathing rates of novice teachers and if this device had any impact on these teachers' pre-post test stress inventory scores and burnout rate scores. The nine teachers involved were novice teachers, working in inclusive classrooms, where 50% or more of their student population was from low SES backgrounds. The research questions that guided the researcher in this investigation were:

(1) To what extent does the use of a biofeedback device affect novice teachers' (1-5 years' experience) breathing patterns in inclusive elementary classroom environments, where 50% or more of the population are students from low SES backgrounds?
(2) To what extent does the use of a biofeedback device change perceived stress levels based on the Teacher Stress Inventory pretest and posttest?
(3) To what extent does the use of a biofeedback device change perceived burnout levels based on the Maslach Burnout Inventory pretest and posttest?
(4) Social Validity Question: To what extent do teachers believe the goals, procedures, and outcomes of a biofeedback device, using breathing feedback, is an effective means of reducing stress as discussed during final interviews?

In this chapter, the researcher presents the results of the data analyses for each of the research questions. The first research question was an investigation of the breathing rates across

baseline and post-intervention (three days each) for the Spire data collected from each individual teacher. To determine whether any changes occurred in mean scores from baseline to post-intervention, teachers' scores were analyzed via a sample of paired t-tests. Three days of teacher baseline and post-intervention rates of stressed breathing were entered into Microsoft Excel to determine any significant changes that occurred following the use of the Spire. In addition, to discuss patterns that emerged, averages were calculated to show positive or negative changes within each teacher.

Research question two was posed as an investigation of the use of the Spire and potential changes in teachers' perceived stress levels based on the TSI pretest and posttest scores. Changes in mean scores from pretest to posttest were compared to determine increases or decreases in individual teachers' TSI scores.

Research question three was an investigation of the differences between each individual teacher's MBI-ES scores. Since the MBI-ES provides a scaled score, each participant's composite mean changes, from pre-test to posttest, were calculated for three categories and compared to the average norm score of a national sample of 4,000 teachers. The areas identified from this instrument included three categories: emotional exhaustion, depersonalization, and professional accomplishment. Each teacher's individualized scores were identified to be above or below the norm for each of the three categories. The author of MBI-ES reports if emotional exhaustion and depersonalization are high, and professional accomplishment is low, then teachers have a higher risk of burnout.

The researcher concludes this chapter with qualitative feedback from the teachers involved, regarding the social validity of their experience using the Spire and overall perceptions about stress and burnout. Their comments are summarized into themes and presented along with quotes that relate to their use of the Spire to provide biofeedback on effective breathing to potentially decrease stress.

Data Analysis

Data for research questions 1, 2 and 3 were entered into a Microsoft Excel spreadsheet for participants who completed a TSI pretest and posttest, MBI-ES pretest and posttest, and a minimum of 26 days of Spire data (three days of pretest, 21 days of data collection, and three days of posttest). The parametric statics were calculated using the Excel software.

Overall Pretest to Posttest Analyses

Research Question 1

To answer research question (RQ) 1, the researcher examined the use of a biofeedback device's effect on novice teachers' (1-5 years' experience) breathing patterns in inclusive elementary classroom environments. The researcher performed a paired t-test for each individual teachers' three days of pretest and posttest Spire data. The researcher presents the results of these analyses in Table 7.

The breathing patterns of all novice teachers in the study differed from the beginning to the end of the device usage. Two teachers had a change in breathing patterns at a statistically

significant level (.05 or less) and the other seven teachers did not show significant changes in their pretest to posttest scores. In three cases, teachers actually increased the number of tense breathing patterns recorded during the post-test data collection. A decrease in breathing patterns of stress, per their Spire data, occurred for 67% of the cases, and 22% were at a statistically significant level.

Table 7

Spire Data

School One			
Participants	Pre	Post	Change Score
Teacher 1	7	0.33	-6.67 (sign .05)
Teacher 2	76.67	38.67	-38
School Two			
Teacher 3	18.67	25.33	+6.67
Teacher 4	17	22.67	+5.67
Teacher 5	46.33	18.33	-28
School Three			
Teacher 6	15	13	-2
Teacher 7	43	3.67	-39.3 (sign. .014)
School Four			
Teacher 8	1.33	7.33	+6
Teacher 9	38.67	14	-24.67
OVERALL AVERAGE	24.54	15.15	-11.39

The Spire data collected shows a decrease in stress over time, from the pretest to the posttest, for teachers' 1, 2, 5, 6, 7 and 9. Teacher 3 had an increase of 6.67 stressed breathing patterns in her average from pre-test to posttest. This teacher reported, during her interview, that she has a disability and also suffers from anxiety attacks. During the post data collection, this teacher reported she became extremely ill during her last day of wearing the Spire, and an

ambulance had to transport her from school to a nearby hospital. This final day showed a large increase in stressed breathing patterns, as would be expected given the circumstances, which impacted her overall average score. Teacher 4 also had an increase in stressed breathing from pretest to posttest of 5.67 on average. This teacher shared she rarely feels stressed or shows signs of stress and did not believe the Spire was accurately tracking her stressed breathing. When discussing her levels of stress at the end of the year, she did explain that she was in charge of the drum club after school, the Girl Scouts after school and weekend programs, and the end of the year school show. She also shared she rarely sleeps through the night. These reported factors could have led to the noted increase in detected posttest data. Teacher 8, who also had an increased rate in stressed breathing from pretest to posttest, noted she is in a Master's program with an added work load. She also ended her interview with saying, "it's the end of the year. I'm just tired." The increased workload was detected by the Spire during the posttest for this teacher, but the primary cause of any changes are not clearly known for any of the cases noted at this time.

Research Question 2

In order to answer RQ 2, the researcher examined the use of the biofeedback device changing novice teachers' perceived stress levels, based on pretest and posttest scores, on the TSI. The researcher reports the change scores for each of the nine case studies in Table 8.

Table 8

TSI Data

School One			
Participants	Pre	Post	Change Score
Teacher 1	2.80	2.42	-0.38
Teacher 2	2.70	2.67	-0.04
School Two			
Teacher 3	3.69	3.94	+0.25
Teacher 4	1.91	1.67	-0.24
Teacher 5	3.04	2.81	-0.23
School Three			
Teacher 6	2.42	2.26	-0.16
Teacher 7	4.12	3.22	-0.91
School Four			
Teacher 8	3.34	3.13	-0.21
Teacher 9	1.84	2.41	+0.56
OVERALL AVERAGE	2.90	2.71	-0.16

The novice teachers' perceived stress levels, based on the TSI, differed from pretest to posttest (Table 8). A decrease in perceived levels of stress per their TSI scores occurred for 78% of the cases in this study: Teachers 1, 2, 4, 5, 6, 7, and 8. Teachers 3 and 9 reported an increase in their perceived stress levels in their assessments. As mentioned, Teacher 3 experienced a medical situation during the posttest phase of this study. This emergency may have increased the teacher's perceived stress. The teacher reported feeling like she was "having off days," and the Spire was alerting her that she was very tense. Teacher 9 mentioned the end of the year was a little more stressful than when the study started, so she noted her perceived stress was higher.

Research Question 3

In order to answer RQ 3, the researcher examined how the use of the biofeedback device changed novice teachers' perceived burnout levels based on the MBI-ES pretest and posttest. The scales in the MBI-ES focus on this group's feelings and measures the frequency of their emotional exhaustion (EE), depersonalization (DP), and sense of personal accomplishment (PA). Each teacher's individualized scores were identified to be above, below, or at the norm of the national sample of 4,000 teachers who took the MBI-ES. A score above the norm in EE and DP, and a score below the norm in PA, are signs leading to potential burnout. The researcher presents the results from each case study in Table 9.

Table 9

MBI-ES Data

Participants	EE Pre	EE Post	Norm (2.4)	DP Pre	DP Post	Norm (2.2)	PA Pre	PA Post	Norm (4.2)	Burnout Probability
School One										
Teacher 1	2.7	1.4	Below	1.6	0.8	Below	5.6	5.9	Above	Low
Teacher 2	2.3	2.1	Below	0.2	0.8	Below	4.9	4.8	Above	Low
School Two										
Teacher 3	4.3	5.8	Above	1.6	2.4	Above	5.3	5.3	Above	High
Teacher 4	1.3	0.4	Below	0	0	Below	4.8	6	Above	Low
Teacher 5	4.4	4.8	Above	2.6	3.6	Above	4.3	4.8	Above	High
School Three										
Teacher 6	4.1	4.1	Above	0	0	Below	5.5	4.9	Above	Moderate
Teacher 7	5.3	4.7	Above	1	2	Above	4.1	4.9	Above	High
School Four										
Teacher 8	2.9	3	Above	0.4	1.4	Below	5.3	4.6	Above	Moderate
Teacher 9	1.8	1	Below	0.2	0.4	Below	5.6	5.9	Above	Low

The novice teachers' perceived burnout levels were based on the Maslach Burnout Inventory, and scores differed from pretest to posttest (Table 8). An increase in perceived levels

of burnout per their MBI-ES scores, compared to the norm score for Emotional Exhaustion, occurred for 56% of the cases in this study. Teachers 3, 5, 6, 7, and 8. Teachers 1, 2, 4, and 9 decreased in their perceived burnout levels, resulting in a 44% decrease. Teacher 1 was very diligent and committed to the study. She utilized the Spire daily and shared that it truly made her more aware of her tense moments throughout the day. This diligent use may have impacted the results of her Emotional Exhaustion score. Teacher 4 reported that she rarely feels stressed or shows signs of feeling burnt out, so her perceived Emotional Exhaustion of herself was lower than the norm score. Teacher 9 also stated that she tries to focus on one thing at a time and tries to prioritize what is most important. This strategy may have impacted her perceived emotional exhaustion.

A decrease in perceived levels of burnout per the MBI-ES standard deviation score compared to the norm score for Depersonalization occurred for 67% of the cases in this study: Teachers 1, 2, 4, 6, 8, and 9. Teacher 3, 5, and 7 had a higher score aligned with burnout in novice teachers, reported as being unfeeling and having an impersonal response toward individuals at the school who provide service, care, treatment, or instruction.

An increase in perceived levels of burnout per their MBI-ES score, compared to the norm score for Personal Accomplishment, occurred for 100% of the cases in this study. Higher Personal Accomplishment is reported to reduce burnout.

Summary of Data Analysis

The following is a summary of each individual case across all data collected. Teacher 1's breathing patterns decreased pre-post at a level of significance, her TSI score decreased, and her overall MBI-ES predicts a low probability of this teacher burning out. Teacher 2's breathing pattern decreased pre-post, but not at a level of significance; her TSI score also decreased; and her overall MBI-ES predicts a low probability of this teacher burning out. Teacher 3's breathing pattern increased pre-post, but not at a level of significance; her TSI score increased; and her overall MBI-ES predicts a high probability of this teacher burning out. Teacher 4's breathing pattern increased pre-post, but not at a level of significance; her TSI score decreased; and her overall MBI-ES predicts a low probability of this teacher burning out. Teacher 5's breathing pattern decreased pre-post, but not at a level of significance; her TSI score decreased; and her overall MBI-ES predicts a high probability of this teacher burning out. Teacher 6's breathing pattern decreased pre-post, but not at a level of significance; her TSI score decreased; and her overall MBI-ES predicts a moderate probability of this teacher burning out. Teacher 7's breathing pattern decreased pre-post at a level of significance, her TSI score decreased, and her overall MBI-ES predicts a high probability of this teacher burning out. Teacher 8's breathing pattern increased pre-post, but not at a level of significance; her TSI score decreased; and her overall MBI-ES predicts a moderate probability of this teacher burning out. Teacher 9's breathing pattern decreased pre-post, but not at a level of significance; her TSI score increased; and her overall MBI-ES predicts a low probability of this teacher burning out.

This summary shows the results for each case varied. Further discussion about why this may have occurred is provided in Chapter 5.

Reliability of Scores

The researcher scored all surveys and inventories first. An independent researcher scored 25% of the pretests and posttests for interrater reliability (IRR). The scores were compared with the researcher's original scores. Interrater agreement was calculated by dividing the number of agreements by agreements plus disagreements, multiplied by 100 (Kazdin, 1982). Point-by-point IOA was used to ensure accuracy of scoring. The criterion for IRR was established at 95%. The IRR for this study was calculated to be at 99%.

Social Validity

As a social validity measure, the teachers were interviewed at the end of study to discuss their lived experiences with the Spire providing biofeedback and their overall thoughts on burnout and stress of novice teachers. Interviews lasted between 7-12 minutes and occurred onsite with each individual participant. The interviews were guided by the questions in Appendix D. The themes derived from the interview were as follows: workload, meetings, paperwork, mentorship, and student behaviors. Themes were grouped by frequency of comments and five themes emerged. The following quotes are presented to substantiate the themes. The daily stress inventories also were collected and analyzed as an exploratory measure to see if any additional patterns could be identified (See Table 10). No clear pattern emerged from this table, but it is interesting to note that teacher 8 was the one whose stressed breathing increased pre to post as did her ratings on the last three days. Teacher 7 also had higher ratings on the last 3 days, and she noted it was due to end of the year procedures. Yet, Teacher 7's spire breathing rates significantly decreased from pre to post assessment.

As noted, this daily rating scale was exploratory in nature and did not provide additional meaningful data. The notes teachers wrote daily next to the daily numeracy rating are not provided to protect the identity of the participants as the notes at times were very personal in nature. These comments were reviewed by the researcher and did provide social validation for many of the comments shared in the interview.

Table 10

Daily Stress Inventory Data

	Participants								
	T1	T2	T3	T4	T5	T6	T7	T8	T9
Day 1	2	2	3	1	4	3	3	3	2
Day 2	1	3	4	1	3	1	4	2	2
Day 3	2	3	3	1	2	2	1	2	2
Day 4	3	1	4	1	4	3	2	2	2
Day 5	2	2	2	1	4	4	1	2	2
Day 6	2	2	4	1	4	4	2	3	2
Day 7	3	2	4	1	4	1	3	3	2
Day 8	1	2	3	1	4	3	2	1	2
Day 9	3	2	3	1	3	1	2	1	2
Day 10	2	3	2	1	3	2	4	2	2
Day 11	1	3	3	2	3	1	2	3	2
Day 12	1	2	3	1	4	2	2	2	2
Day 13	1	1	3	1	4	3	4	1	2
Day 14	1	2	3	1	2	1	3	4	2
Day 15	3	1	2	1	4	1	2	1	2
Day 16	3	3	4	1	4	1	4	2	2
Day 17	1	1	2	1	3	1	2	2	2
Day 18	2	4	2	1	3	1	3	2	2
Day 19	1	2	2	2	3	1	3	2	2
Day 20	1	2	3	1	4	2	2	1	2
Day 21	2	2	1	1	4	2	2	1	2
Day 22	2	1	2	1	4	3	4	2	2
Day 23	3	2	3	3	4	2	2	2	2
Day 24	1	3	3	1	4	3	2	4	2
Day 25	1	1	2	1	4	2	2	4	2
Day 26	2	1	3	1	3	3	4	4	2
Day 27	3	2	2	2	4	3	4	4	2

Workload, Meetings and Paperwork

Teacher 5 stated that one of the main causes of stress was “Definitely handling the students’ behavior and their lack of wanting to comply with demands or requests, and then the workload. Writing IEPs documenting it; that would be the biggest stress.” Teacher 6 noted, “Yeah, I’m like okay, wow; I’m doing paperwork. I’m just sitting at a desk doing paperwork because they are asking for all of this paperwork. And, it’s like, ughhh (spire going off). So you kind of get to see what triggers it, what triggers you, and what triggers your Spire to go off. And see if you can find ways to just kind of relieve some of that stress and calm down.”

Teacher 7 shared,

> “The training that we get done in college, its good but it’s a lot of hands-on, first year experiences. Like, we have to do a lot of paperwork-wise, and like teaching special education, you have to deal with assistants. So like how to work with assistants and the difficulties you have with that. And a lot of the paperwork. Or like they tell you how to write the IEP goal, but there’s so much more that goes along with that. It’s all the little stuff. How to do all that, all the stuff that should be happening, and it varies from school to school” (T7, May 18).

Teacher 1 mentioned,

> “well, I’ve noticed with this Spire that I am more stressed like sitting. And with like meetings and more getting told what to do, not more of like knowing what to do, but that is kind of how it is. What we are doing and not more of an administrative, but of more team lead perspective, because those people also run our teacher meetings as well. Not so

much the principal or administrator, but sometimes the team lead will be like, oh you have to do this by this by this" (T1, May 9)

Teacher 2 also mentioned paperwork as a stressor:

> "Paperwork…just the amount of demands happening. Like you need this paperwork in, you need to call them, you need to do this, you need to write this out, yeah. Because there's too much of it, and you're like why can't I just teach and focus on the kids and not have all of this formal like paperwork to fill out? And just a million things. And I don't have the time, and I want to just teach my kids" (T2, May 17)

Teacher 2 mentioned staff meetings as well:

> "When it {Spire} would go off, I would just kind of look around, and I would laugh and go ha, yeah. I really laughed because probably most times it would go off consistently would be in like staff meetings, and it would continuously go off. And I'm just like, that's funny. Because I would be sitting there the whole time (tapping fingers on desk), like come on; I have a thousand other things to do! I really don't care about this right now."

Teachers 1, 5, and 7 stated workload was one of the main causes of stress. Workload pressures came from colleagues, grade level team leaders, and quantity of daily tasks beyond that of simply teaching. Another major stressor mentioned by Teachers 1 and 3 were the meetings they were required to attend, and both noted the Spire vibrated at the highest rate of the day during these meetings, a finding not currently discussed in the literature. Teachers 2, 5, 6, and 7 all mentioned paperwork as a stressor. These teachers mentioned stress related to IEP documentation, having too much in general, and that the Spire often alerted them to this stress

during paperwork activities. One teacher noted that she wanted less paperwork so she could just do her job of teaching kids.

Mentorship and Student Behavior

A need for mentorship was brought up by seven of these novice teachers. Teacher 5 stated, “to have a mentor helping walk through, like how to take the data or having someone assist with taking the data just to lessen the work load while I’m trying to learn how to do it. And doing it at the same time.” Teacher 4 stated, “I think the number one thing that contributes to stress in the class, and I don’t really let it turn into stress, but when I see a student having a break down” (T4, May 17).

Teacher 6 stated,

> “I guess, really, coming in and talking to first year teachers and finding out what is really stressing them. Like if there is a particular time of the day. If there’s a particular subject matter. If there’s something that they feel, like it could be paperwork, and assisting them with that. Or maybe getting them a mentor who could assist them with that” (T6, May 10).

Teacher 7 mentioned,

> “More behavior support {mentors}, and almost like this is how it runs at our school, this is what to do at our school, and a “how to” pamphlet. Like, oh parent conferences, flip, this is the form we fill out. Make sure you tell them with this much notice. This is how you tell them. This is the things you should discuss in there. This is approximately when you will have it” (T7, May 16).

Teacher 2 stated,

> "kids' motivation and effort, and just seeing behavior and wanting to be like, you are so capable! Just stop it! If you would stop it and focus, you could do so much more! You know? Most of it is just frustration of knowing what the kids are capable of, and you know seeing their meltdowns and lack of effort, and it's like why?! Trying to figure out how to keep them truly motivated" (T2, May 17).

Teacher 1 mentioned,

> "They need to know consequences. Oh, if I pick up my chair and I throw it across the room, then this is going to happen. As a teacher, I don't have that discipline part. I don't have that immediate discipline where I can say like a kid kicks over their desk and hits books out of another kids hands. I don't have any discipline to say 'oh, you did that, okay, then this now is your consequence'" (T1, May 9).

Teachers 5, 6, and 7 stated mentorship would be helpful in reducing the stress created at work. Teacher 6 made a connection between mentorship and paperwork, stating she needed more support in the array of tasks she had to complete. She stated that having a mentor could help with the stress paperwork creates for her. Teachers 1, 2, 4, and 7 also mentioned student behavior as a stressor at work. These teachers noted they either were derailed by misbehavior and became overwhelmed, or they did not have a toolkit to help them manage the plethora of behavior issues in their classroom. Teachers mentioned that when student behavior was high, so were the vibrations giving biofeedback to them related to their stress. Yet, decrease by breathing, at times, was not enough.

Spire and Biofeedback

The majority of the teachers truly enjoyed using the Spire and receiving biofeedback. Teacher 5 stated,

> "I think it was effective just to keep me like thinking about how I'm feeling and my stress levels… I thought it was really interesting. I loved checking my phone. I usually checked it at the end of the day, but I noticed a lot. Like some days were really tense, and then I realized on those days, also, I wasn't moving around that much. So, I feel like I was tense because I was just building up; but then the days when I was tense but I was moving around a lot, I wasn't tense as much. Because if I am moving around and I'm running, then I'm more focused then tense. So, I feel like that was really interesting to see" (T5, May 18).

Teacher 6 stated,

> "sometimes I felt okay with it, and then sometimes this thing would start vibrating; and I would get more stressed because its vibrating and telling me to calm down. And I can't calm down, so it just… but it was interesting to see where I was focused, calm, stressed, and then see what put me there. And a lot of it was just the environment in the classroom" (T6, May 10).

Teacher 3 discussed,

> "Well for me, Spire was most important for me when it would give me, like I use Spire. It would tell me to take a breath; that's what I loved most about it. You know, like when it buzzed and stuff, but it would also help tell me to take breaths. And I didn't realize I do

not breathe a lot, you know, when I'm really stressed. So, just remind me to take a breath because I didn't realize how bad I was at that" (T3, May 11).

Teacher 2 stated,

> "But just being aware that something is happening at that point, you know, makes me a little more conscious of things that are happening in the room. Like, why did that just go off right now? Was it something a student said? Was it the whole situation? You just kind of being a little more conscious about, you know, when and why I personally stress out" (T2, May 17).

Teacher 8 mentioned,

> "I think it could be an effective tool for people that are not as aware of their stress and anxiety in general… teach you how to recognize the signs that your body is giving you before you get too far into it. So, yeah, I think it's effective. It would be an effective tool if I didn't already know what to look for" (T8, May 15).

Teacher 9 also stated,

> "I do think that it was effective in the sense that you get so distracted with this focusing on the kids and teaching that you forget about what you need to stop and take a deep breath. The same thing we try to teach the kids" (T9, May 17).

Teacher 1 mentioned,

> "I really enjoyed this! I liked that you could actually see it, and track the exact time, and then you can go edit it about what you were doing. But by the time you are so in the moment, it's a little harder to do all of that stuff. Daily, I can say like, yeah, during this

time, this stuff happened… So, I think the Spire was very accurate like the calming part and the focus part" (T1, May 9).

Teachers 1, 2, 3, 5, 6, 8, and 9 spoke positively about their experience with biofeedback and using the Spire during the study. Tracking their breathing was helpful in making the teachers aware of their stress and the triggers of their stress. Some teachers noted that, despite the feedback, they still could not control the stressor; however, they could take a deep breath and refocus on what they could do at that moment. Many mentioned, again, needing a mentor to help them make decisions when the Spire did vibrate because, as novice teachers, they did not have a solution to solve the stressful situation (e.g., behavior, after school meetings, workload).

The researcher also observed the demands of work, such as state testing and grade level requirements, led to tense breathing, which were not discussed during the record interviews but discussed in casual conversation. Since the teachers' tense breathing outside of instructional time was not a research question posed in this study, those differences were not discussed. However, the potential impact on the teachers' tense breathing and stress were most likely impacted by the differences in school wide requirements such as being pulled away from the class for IEP meetings, afterschool meetings, lack of mentorship, and student behavior that occurred both during and outside of instructional hours or took away from instructional hours. This issue is discussed in Chapter 5 as a consideration for future research.

Overall, teachers' patterns of change varied. This exploratory study showed, for some teachers, the Spire did impact their breathing patterns and their stress and burnout rates, but only on a case-by-case basis. Further research is warranted to determine why some teachers were and

others were not impacted by this biofeedback tool. These findings, future research, and other relevant issues, aligned with the current literature, are provided and discussed in Chapter 5.

CHAPTER FIVE: DISCUSSION

Introduction

New approaches to managing teacher stress are possible with advances in technology. New technological devices have rapidly entered the world (Fitbit, Apple watch, etc.) and have increased societal attention on health and overall well-being (Lewis, Napolitano, Buman, Williams, & Nigg, 2017). Many of these new technological tools use some form of biofeedback (Friedman, 2000; Stein, 2001; Reiner, 2008; Schwartz & Andrasik, 2017). Biofeedback involves the voluntary control of physiological mechanisms such as breathing rates. The benefits of receiving this type of biofeedback has been found in fields such as nursing (Wallace, LeWin, De Grood, & Schaefer, 2011; Ratanasiripong et al., 2012; Ratanasiripong et al., 2015), public health (Calderon & Thompson, 2004), customer service (Kennedy & Pretorius, 2008), sports (Todd, 2011; Perry, Shaw, & Zaichkowsky, 2011), and the workforce (Moraveji et al., 2017) to reduce anxiety, tension, and stress. Researchers (Friedman, 2000; Stein, 2001; Calderon & Thompson, 2004; Kennedy & Pretorius, 2008; Reiner, 2008; Todd, 2011; Moraveji et al., 2017; Schwartz & Andrasik, 2017), in their reviews of literature on stress management techniques, have noted the benefits of using biofeedback in numerous professions. Despite research in other fields and growing popularity of biofeedback devices in society in general (Coakley, 1992; Wilson, Peper, & Moss, 2006; Morgan & Mora, 2017), the use of this type of tool and feedback to potentially reduce the stress levels of novice teachers in schools serving students from low SES backgrounds has yet to be explored. Raising teachers' awareness of the health issues of stress and burnout and ways to reduce both issues, specifically for novice educators serving students from low SES

backgrounds, could prove to be valuable in overall teacher well-being and even potentially reduce teacher attrition rates (Friedman, 2000).

The potential use of emerging tools in biofeedback to help reduce stressed breathing patterns of novice teachers, in classrooms where more than 50% of their students were from low SES settings, was the focus of this study. In this chapter, the researcher provides a summary of the overall purpose and outcomes of this mixed methods study. Next, the results of the study are compared and contrasted to the current literature in the field, followed by recommendations to further expand this work and the use of biofeedback in education. A discussion is then provided about limitations of the research and suggestions for future research.

Purpose and Procedures in the Study

The purpose of this study was to explore the effectiveness of biofeedback on breathing rates of nine novice teachers, in their inclusive classrooms serving students who 50% or more were from low SES backgrounds, to potentially decrease their stress and burnout rates. The researcher focused on stress created by the classroom environment and tracked breathing patterns during the instructional day by providing novice teachers with an awareness of tense breathing to make teachers more mindful of their breathing rates throughout the day. By monitoring and alerting teachers of their tense breathing, using a biofeedback tool called the Spire, Inc., some of the teachers became more aware of what triggered stress in their classrooms.

After receiving permission from their administrators, nine teachers agreed to participate in the study. Each teacher participant wore the Spire for three days in order to determine baseline data. The participants were then taught how to use the Spire and the purpose for the use of the

device to help decrease stress and stressed breathing patterns. In addition, teachers were asked to complete the TSI and MBI-ES to gather pretest scores on stress and burnout. On Days 21-24, posttest data were gathered as a return to baseline for the Spire data and was collected over three days. Teachers also completed the TSI and MBI-ES posttest. In addition, throughout the study, all participants were asked to complete a daily stress rating scale and note any specific stressful event they felt they encountered that day while wearing the Spire.

The researcher analyzed the results of the pretests and posttests for the Spire using a paired sample T-test. The performance of novice teachers on the pretest and posttest TSI and MBI-ES measures were examined on an individual basis. Differences were explored through non-parametric and descriptive statistics in order to identify patterns related to each teacher's mean scores. The results are grounded in a real school and classroom setting, which created limitations that need to be considered when reviewing the data.

Summary of Findings

The results from the Spire-collected breathing rates showed 22% of the teachers had breathing patterns decrease pre-post at a level of significance. For the TSI, 78% of the nine teachers showed a decrease in perceived levels of stress. The MBI-ES showed mixed results for potential burnout; 44% of the teachers had a low probability of burnout, 22% of teachers had a moderate probability of burnout, and 33% of teachers had a high probability of burnout.

The theoretical framework for this study (Gaillard & Wientjes, 1994) is that reduction of mental load of preservice teachers aligns with a reduction in stress-related events. Gillard (2001) found when someone is coping effectively, mental load tends to be task-focused, but when under

stress, the response appears to be emotion-focused. Based on the findings, the researcher supports this framework in that teachers who did respond to the Spire at levels of statistical significant also had lower TSI and MBI-ES scores, indicating they are less likely to leave the field. Gaillard and Wientjes' (1994) theory notes that in professions where there are high demands but low control of the tasks (e.g., in teaching), the outcome can be the development of stress symptoms. Without effective emotion regulation and coping strategies, teachers are more likely to experience higher levels of stress and emotion-focused coping leading to burnout, especially on the dimension of emotional exhaustion (Chang, 2009). In this study, an increase in perceived levels of burnout per the teachers' MBI-ES scores, compared to the norm score for Emotional Exhaustion, occurred for 56% of the cases in this study. Teachers may benefit from effectively understanding their mental load and their response to both emotion-focused coping and task-focused coping in order to implement strategies essential to easing stress and burnout (Lazarus, 2006; Chang, 2009). The research in this study supports how the level of turnover rates in the first five years are cited to be between 40-50% (Ingersoll & Merrill, 2012), due to dissatisfaction with the career from stressors within the school environment (Ingersoll & Smith, 2003).

Today, national estimates suggest that between 19% and 30% of teachers leave the profession within the first five years, with higher turnover (up to 55%) in urban, high needs (eligible for Title 1 support) schools, noting stress as the primary reason (Barnes et al., 2007; Podolsky et al., 2017). The current study shows potentially five of these teachers are at risk for burnout and leaving the field. This cumulative effect of stress is one of the reasons cited for high turnover rates of teachers (Barnes et al., 2007; Sutcher et al., 2016; Podolsky et al., 2017).

Certification

Many certification issues still remain in how teachers address students from diverse backgrounds and those with disabilities (Ladson-Billings, 1999; Darling- Hammond, 2016; Bales, 2006). The Reauthorization of ESEA in 1994 mandated state implementation of the Goals 2000 systemic reform policies (Bales, 2006) and focused on teacher education practices in general education settings. The national mandate went as far as requiring teachers to be highly qualified. The results from this study showed 100% of the teachers who were dually certified, as well as having full state certification or licensure, were still stressed daily. Even though these teachers were highly qualified, they were still expressing concerns of not feeling prepared and stressing about how to meet the needs of students in low SES schools. Despite all of the legislative reforms, the stress of being a new teacher still exists. Teachers are not being prepared on how to balance requirements in the first years of teaching, such as mandatory professional development, parent teacher conferences, and other requirements outside of simply teaching their students. Teachers need more hand-over-hand support during their first years with an on-site and classroom-based mentor to model behavior management, data collection, or whatever else a teacher deems he or she needs to successfully meet student learning needs. The need for mentorship should occur over three-year periods to help with stress and increase retention.

Mentorship

Mentoring and induction programs are one avenue researchers have supported to relieve stress for novice teachers and to reduce burnout (Holloway, 2001; Smith & Ingersoll, 2004; Wilson, Darling-Hammond, & Berry, 2001). Mentoring provides support and assistance to

novice teachers (Prilleltensky, Neff, & Bessell, 2016), which should not be confused with randomly pairing novice teachers with more experienced teachers without guidance, formal objectives, orientations, or time to collaborate (McCann, Johannessen, & Ricca, 2005; Prilleltensky, Neff, & Bessell, 2016). Mentorship for novice teachers in high needs schools should include several levels of support: (a) direct mentorship from an experienced and effective teacher from the same discipline and classroom type of structure; (b) time to collaboratively plan and create synergistic classroom goals with teachers within the same discipline; (c) building a network to access, understand, and harness school, district, and community resources; (d) better qualified and collaborative structures for working with teacher assistants; and (e) frequent and supportive communication with administrators at all levels (Smith & Ingersoll, 2004; Ingersoll & Strong, 2011; Guha, Hyler, & Darling-Hammond, 2017). Providing novice teachers with these types of resources are reflected in both the literature, in the data collection in this study, and in the voices of the 9 cases through interviews and conversations.

Specifically, five of the novice teachers' perceived mentorship would have helped reduce stress in their first years of teaching. One teacher stated mentors would be beneficial in multiple ways. She gave several examples as to how a mentor might help:

> "… This week, we were told 2 weeks ago that we would have to stay until 6 o'clock, and we had to adjust our schedules to be able to be here for 3 days until 6 o'clock. And as a first year teacher, being like, what is this! Being told more in advance … this is how you write an IEP. Is your child doing this stuff? Great, break it down and write it. How to work all of it. What trainings to go to … I found out I need to do this training that

should've been done in September, and they take it at the end of their first year and … this [mentoring] would've been great at the beginning of the year" (T7, May 16).

Teachers 5, 6, and 7 stated mentorship would be helpful in reducing the stress created at work. Teacher 6 made a connection between mentorship and paperwork, stating she needed more support in the array of tasks she had to complete. She stated that having a mentor could help with the stress paperwork creates for her. A suggestion would be creating a more hands-on mentor program to help reduce novice teacher's stress and burnout, such as a teachers in residency program. This type of program would allow a novice teacher to have an expert teacher in his or her classroom daily while still reaching autonomy in ability to lead without direct support. This type of residency program would parallel the practices observed in fields like medicine where novice doctors work in tandem with experts. The mentoring from the expert teacher could include teacher modeling instruction, providing examples of how to write IEP's, how to conduct or participate in a meeting, and creating a plan to help the novice teacher reduce his or her stress daily.

A primary recommendation that emerged from this study is for leaders to help novice teachers identify more internal solutions to problems rather than expecting that support will come from an external source. Many teachers working in low SES schools may only be surrounded by other novice teachers, hence finding self-sustaining ways to reduce stress is critical. Novice teachers need to be provided resources they can use as references throughout the year when they are struggling such as a resource notebook with specific materials related to their school in an easy-to-access format. This toolkit of resources could provide guidance on all of the "hidden" requirements that cause stress for novice teachers (e.g., PD procedures, evaluation

process, testing procedures, behavior management processes, scheduling, etc.). This toolbox of resources also would allow teachers to access these various procedures without fear of asking an administrator or appearing incompetent. These types of tools could reduce stress related to simply not knowing or not knowing who to ask. Teachers need a toolkit in order to allow them to, as best said by one of the participants in this study, "just teach."

Unique Opportunities and Supports Needed in Low SES environments

Although the challenge to retain highly competent teachers affects all schools, the shortage is critical in schools serving students from low SES backgrounds (Carver-Thomas & Darling-Hammond, 2017; Darling-Hammond, 1999). These schools historically suffer from a severe shortage of qualified and licensed teachers (Carver-Thomas & Darling-Hammond, 2017; Darling-Hammond, 1999; Ingersoll, 1995; Quartz & Group, 2003) and have high turnover rates. They also employ a disproportionately large number of novice teachers, who are shown to be less effective than those with more experience (Clotfelter, Ladd, & Vigdor, 2005; Grissom, 2011; Rivkin, Hanushek, & Kain, 2005; Sutcher, Darling-Hammond, & Carver-Thomas, 2016). Hence, the cycle of low educational outcomes is closely paired with high levels of turnover and stress, creating a dismal outcome for teachers and students alike (Barnes, Crowe, & Schaefer, 2007; Sutcher et al., 2016; Podolsky et al., 2017). The novice teachers often have a heightened sense of purpose for teaching, but typically a limited toolkit to deal with the unique challenges found in high-need environments (Ladson-Billings, 2006). These concerns were validated, and at times, celebrated by the teachers in this study.

One teacher stated, “I think overall, it’s just the overall system that’s broken and may need to be fixed. As teachers, we are doing our best with what we have. That’s all we can do at this point.” When talking about the environment of the school, another teacher stated, “{I} lack materials, because my kids are different they don’t learn the same or use the same things” but the school cannot provide the materials the students need for academic success and this teacher shared she was worried about her students’ futures. This novice teacher noted she was provided with a limited toolkit and worried, as was noted in Ladson-Billings (2006), of promoting the cycle of low educational outcomes and resulting in potential teacher turnover and stress. Specifically, this novice teacher shared with me directly that she was looking for jobs elsewhere at the end of the year. She noted it was not about the teaching profession, but about not being provided with what she needed in order to make her students successful. A recommendation for the field to consider is to provide teachers with higher pay, better resources, and appropriate administrative funding for classroom resources to better meet the needs of students from low SES backgrounds. Novice teachers may benefit from exposure to funding outlets like Donor’s Choose, GoFundMe, and other grants. Community and district resources are needed, but as this teacher said, her students “don’t learn the same or use the same things,” sharing her need for unique, targeted, and specific resources to effectively impact learning outcomes. Teachers also should be given the opportunity to be creative in their classrooms to use tools such as universal design for learning (UDL), project-based learning, innovative technology, alternative seating, or any other tool a teacher believes will directly impact her students’ ability to learn in a low SES environment. Empowering teachers with direct support, but control of their learning environment and students’ academic success, could lead to less stress and burnout.

Another recommendation would be having a designated secretary for each teacher to complete the paperwork or a designated time with the mentor to focus only on completion of paperwork. Also, after school meetings should be kept at a minimum and replaced with web-based meetings or prerecorded podcasts so teachers do not have to spend copious amounts of time away from their other, important duties. Administrators working with novice teachers, or just in general with their staff, may want to consider shorter, more structured meetings. An example would be to have a stand-up meeting. Edutopia provides an example (https://www.edutopia.org/school/philadelphia-performing-arts-charter-school-string-theory-school) of this type of meeting, called a 60 second strategy, and provides a video of this practice at String Theory School in Philadelphia. The weekly staff meetings at String Theory are timed and last 15 minutes at most. Teachers bring up, at the meeting, what they are concerned about, what is going on in their classroom, great ideas they want to share, or what they would like to celebrate. If someone does not have anything to add, they can pass and the next person has a chance to talk. They share they have conducted staff meetings this way for the past five years. The administrator's share this model respects and values a major stressor for most teachers -- time. This type of stand-up meeting is a great solution to consuming less of teacher's time and may reduce stress, which peaked for the teachers in this study during after-school meetings. Finding ways to reduce stress of novices from the beginning of the day to the end may be what is needed to help reduce burnout and teacher turnover.

Teachers in low SES schools should be able to utilize books, videos, technology, and any material they and their students deem engaging in *their* classrooms to promote learning gains.

Creating this personal connection with students could help in so many ways, both academically and behaviorally, while lowering stress for everyone.

Classroom Management

Novice teachers report they are stressed over classroom management and student discipline (Bondy, Ross, Gallingane, & Hambacher, 2007; Robertson, 2008; Ross, Romer, & Horner, 2012; Dicke, Elling, Schmeck, & Leutner, 2015; Ouellette, Frazier, Shernoff, Cappella, Mehta, Maríñez-Lora, & ... Atkins, 2017). Research has shown the lack of exposure and inexperience in the classroom in these areas could be combatted with professional development (Bergeron, 2008; Dicke et al., 2015; Prilleltensky, Neff, & Bessell, 2016). In order for professional development to be valuable, the focus should be on specific skills and techniques novice teachers need to improve in targeted areas, such as classroom management (Kennedy, 2016).

In this study, student behavior was mentioned by 67% of the novice teachers during the final interviews. Teachers shared that the highest level of stress was created by student behavior and classroom management, similar to findings noted by Ouellette and colleagues (2017). For example, one teacher noted,

> "I think the number one thing that contributes to stress in the class, and I don't really let it turn into stress, but is when I see a student having a break down. And I'm trying to help them, but it's beyond their control. It's out of their hands. I couldn't stop that trigger, or I had a student that would randomly, and I mean he was really screaming at the top of his voice, and a piercing screaming. And, he was hitting himself, and he was throwing

things. Not as bad. I mean, it would be like a pencil. He was starting to throw a chair, but we luckily got that part down…It's just like you're trying to help them, but you see it's beyond them at some point. I see that is when you're just trying to help them, and you just can't get there. I think that to me that is biggest stress" (T4, May 17).

Teachers 1, 2, 4, and 7 mentioned student behaviors as a stressor at work. These teachers noted they either were derailed by misbehavior and became overwhelmed, or they did not have a toolkit to help them manage the plethora of behavior issues in their classroom. Teachers mentioned when student behavior was high, so were the vibrations giving biofeedback to them related to their stress; yet, decrease by breathing at times was not enough.

Historically, teacher preparation programs have struggled to find the way to address behavior/classroom management. Programs should consider including observations, discussions, and simulations while shaping teacher behavior for diverse classroom environments. This shaping of behavior would include examples of positive praise. Teachers should not be taught a one-size-fits-all behavior management plan, but should learn consistent, high leverage practices to manage behavior so the focus can be on learning instead of meetings. One teacher in this study mentioned she just could not connect with her students because they were "not like she was raised." Novice teachers should have the opportunity, before entering the classroom, to discuss their personal perceptions of students with regards to behavior and learning. A recommendation emerged directly from one of the teachers during her final interview. She stated,

"Making sure when teachers are hired, they know exactly what they are in for. If possible, having teachers do like an in-classroom interview rather than in an interview room or the office. But after they are already hired, like making sure, we deal with a lot

> of behaviors. I mean, I learned through a crash course; by now, I've been teaching for 5 years, so I'm good with behaviors. They typically give me the kids with behaviors. A lot of new teachers, they don't have the support. They don't know what they are doing, and the crash course, a lot of people can fail, which is detrimental to the teacher, that child, and other kids in that class" (T7, May 16).

Asking teachers to come in to actually teach a lesson as part of the interview process could help teachers and administrators alike see a lack of fit for a specific school environment.

Stress and Biofeedback

Evidence is provided by Day and Hong (2016) to show teaching is stressful and emotions play a key part in the process of building and sustaining resilience in educators. Teachers' everyday interactions with students, interactions with colleagues, IEP meetings, school-wide meetings, classroom management, reactions to student behavior, and ability to implement curriculum all can impact stress (Mashburn, Hamre, Downer, & Pianta, 2006; Hamre, Pianta, Downer, & Mashburn, 2008; McLean & Connor, 2015). Teachers 1, 2, 3, 5, 6, 8, and 9 spoke positively about their experience with biofeedback and using the Spire during the study. Tracking their breathing was helpful in making the teachers aware of their stress and the triggers of their stress. Some teachers noted that, despite the feedback, they still could not control the stressor, but could take a deep breath and refocus on what they could do at that moment. Many mentioned, again, needing a mentor to help them make decisions when the Spire did vibrate because, at times as novice teachers, they did not have a solution to solve the stressful situation (e.g, behavior, after school meetings, workload).

Researchers who have reviewed the literature on stress management techniques have noted biofeedback is helpful in various professions (Burish & Jenkins, 1992; Ratanasiripong et al., 2012, Klich, 2016). Raising teacher's awareness of the issue of stress and burnout, specifically for novice educators in high-needs, inclusive classrooms, seems an important next step in combating burnout (Friedman, 2000). Teachers who are more aware of their stressors are more likely to emphasize positive student behavior and respond supportively to students' negative emotions (Li-Grining, Raver, Champion, Sardin, Metzger, & Jones, 2010; Swartz & McElwain, 2012).

Biofeedback could be a helpful tool to support novice teachers by creating awareness of tension and stress-related breathing rates to increase self-awareness and decrease stress (Sparks, 1983; Friedman, 2000). Biofeedback tools can directly measure autonomic breathing by providing a signal that nature did not build into the human system to monitor. Awareness of this signal provides an opportunity to learn through self-correction, and eventually, the alteration of a physiological state, in real time, to help a person monitor the behavior of a targeted intervention (Reiner, 2008; Schwartz, 2010; Schwartz & Andrasik, 2017).

The results of this research study showed clear variation across each individual teacher's pretest and posttest means, with regards to the use and effectiveness of the Spire, and their perceived stress and burnout. Overall, decreases in mean scores were observed for 78% of the teachers from pretest to posttest on the TSI. Also, a change in mean scores was found for the teachers from the pretest to the posttest of the Spire, as well as two teachers showing breathing patterns decreased pre-post at a level of significance. Finally, each individual teacher's pretest to posttest MBI-ES scores showed both increases and decreases, with three teachers showing signs

of potentially high burnout. Seven of the nine teachers showed an overall decrease in pretest-posttest mean scores on the TSI. Similarly, the MBI-ES showed mixed results. When examining the individual teachers' analyses, the novice teachers showed no clear patterns emerging individually or as a group.

The teachers also had mixed reactions to the Spire, but the majority reported they enjoyed wearing the Spire. One teacher said that the Spire was interesting because the device helped her learn a little bit about herself such as which kid sets her off, which kids did not set her off, and what biofeedback can do to help her more effectively help her students. It also taught her how her energy plays into her students, and how their energy plays into her stress. This teacher noted that the Spire allowed her to have awareness of what triggers her emotions and what triggers the Spire to go off while seeing if there are ways to relieve some of her own stress and to "calm down." Teachers may benefit in being allowed to choose a stress-detecting, biofeedback device from a group of different devices. Providing a choice could increase participation and investment to demonstrate positive effects from the use of various biofeedback devices. Another recommendation that emerged with one of the novice teachers' during an interview was

> "something that would be cool, because there was a day or two that I forgot to wear it, if there's a setting you can put on the app. Like what hours you want to make sure you wear it, and it like alerts you at that time. Like oh, make sure you put your Spire on at that time. But, before I left the house, not like, oh I'm at work and I don't have it on…If it vibrated at 8, and like are you wearing it? You could set the setting… to remind you to wear it. That would be cool" (T7, May 16).

Having a reminder system coincide with the use of the biofeedback could be a future consideration to further impact novice teachers' breathing or stress levels and to remind them to wear a biofeedback device every day.

Implications of Findings

Results from this study have implications for practitioners and researchers in the field. Due to novice teachers in low SES, inclusive elementary classrooms experiencing high levels of stress and anxiety, resulting in attrition, ways to reduce stress are needed. School leaders should consider developing a systematic nomination process to identify and provide focused support to teachers in need. The current study offers a framework of lessons and future considerations for the integration of biofeedback and mindful breathing to support novice teachers. Stress from other sources (outside of work) also were reported by teachers as impacting their overall stress and tense breathing. Providing novice teachers with mindfulness stress reduction is a positive option to consider for some, but not all. Supporting teachers' ability to cope with the stress by reducing cognitive load, as noted by the theoretical framework provided by Gaillard and Wientjes (1994), could strengthen novice teachers' wellbeing while alleviating anxiety, leading to reduce teacher turnover. This reduction in turnover is important not just for the wellbeing of the teacher, but also for the children in low SES schools who often experience a novice teacher each year.

Researchers also should focus on efforts in developing the potential link between teacher behavior change and student outcomes (behavioral and academic) in the classroom. Lower stress and retaining teachers is irrelevant if student learning is not impacted.

Limitations

This study had several limitations due to the time of year, the number of teachers, follow-through with the device use, IRB approval, and impact of state testing. This study occurred with only nine teachers in one school district. Further research should involve a wider range of schools, districts, and number of teachers. Another limitation was follow-through of teachers using the device consistently. Allowing teachers to select from various models of biofeedback devices could increase their investment. The researcher suggests future studies incorporate a reminder system, which could be utilized to help teachers remember to wear the Spire daily.

Also, perceptions of workplace stress, as well as strategies for coping with stress and anxiety, can vary due to cultural factors. Cultural context (e.g., the society in which a school is located, cultural backgrounds of teachers and students) should be considered before designing mindfulness-based stress management programs in culturally diverse locations.

Another limitation is related to timing issues. The study lasted 30 days, but when teachers would forget to wear the Spire, the study would extend until the timeline was complete. However, it was necessary for the researcher to be sensitive to the time constraints of the teachers as they were involved in both personal health issues as well as direct needs of their classroom related to state testing.

The timeline of the study was greatly hindered by an unexpected delay in the university Instructional Review Board process. The researcher began the approval process in early November, but approval took more than 90 days. Thus, the researcher was not able to begin data collection until the end of March, which was two months before the school year ended. Further complicating the completion of the study were three events during which time the researcher was

unable to receive Spire data: spring break, state testing, and the Flu. Due to the realities of applied classroom research, it was not possible to control for these variables, which could have had an effect on teachers' breathing patterns as well. Finally, given the differences in timing, some teachers had to wear their Spires into the final days of the school year.

Future Research Directions

Four overarching themes related to future studies emerged from this research: (a) the need for specificity related to student behavior and work related meetings/requirements; (b) research design; (c) instrumentation; and (d) timing. Recommendations for future studies are provided.

The stress teachers feel from work is dangerous (Kyriacou & Sutcliffe, 1978; Russell, Altmaier, & Van Velzen, 1987; Pithers, 1995; Kyriacou, 2001; Johnson, Cooper, Cartwright, Donald, Taylor, & Millet, 2005). Considering the variability in teacher stress, it might be beneficial when designing future studies to utilize and assess very specific times of days or content areas.

Stress also impacts teachers' ability to deliver instruction effectively, which has implications for student learning and achievement (Ransford, Greenberg, Domitrovich, Small, & Jacobson, 2009; Shernoff et al., 2011). What is needed in the field is a deeper dive into the biofeedback patterns of teachers when students fail and when students succeed to try and determine a pattern in both novice and expert teachers. Future tools such as functional magnetic resonance imaging (fMRI), Empatica, MUSE Headband, skin electrodermal activity, speech patterns, and heart rate variability could begin to help educators understand the complexities of

stress, the triggers of tension, factors leading to burnout and potential patterns of successful teaching and learning outcomes no matter the environment, zip code, or setting within which they teach.

Given that the researcher had difficulty with teachers remembering to wear the device every day, future research might focus on the creation of an instrument that alerts and reminds teachers to wear devices that positively impact their performance and decrease their levels of stress. If new patterns of behavior can be learned with the device, over time, those changes have been found to endure without use of an instrument (Schwartz & Andrasik, 2017). One potentially viable way to assess these changes may be to use observations and a rubric to filter out differences between classroom tension versus additional teacher requirements (staff meeting, IEP meetings, paperwork). Teachers in this study often mentioned, and Spire data showed, after school meetings were one of the highest stressors for novice teachers. This pattern is in need of further investigation and consideration.

Furthermore, a mixed methods study that incorporates structured interviews with teachers is another viable method for addressing the issue of stress and burnout emerging in the literature, as well as with the customization of interventions like mindfulness-based stress reduction exercises. These interviews and mindfulness interventions could be tailored to meet the distinct needs of novice teachers in inclusive, high needs settings, based on reduction in stress levels measured through devices and venues. This customization may lead to more investment in the study for each teacher and greater changes in levels of stress and burnout.

A more customized approach was recently conducted by Ratanasiripong et al. (2012) using a randomized controlled study with a new generation of portable biofeedback equipment to

help address nursing students' stress and anxiety. The impact was significant reduction in both areas. Ratanasiripong and colleagues (2012) found the biofeedback group maintained the same level of stress over a five-week period despite being put in a high stress and high demand setting, much like is seen for novice teachers in low SES schools. The control group was exposed to the same demands and stressor but had a significant increase in their stress levels over the five-week period of clinical training without biofeedback. Additionally, the biofeedback group had a significant reduction in anxiety, while the control group had a moderate increase in anxiety. Ultimately, the more psychologically healthy the nursing students were, the more they flourished and graduated to become productive and contributing members of the nursing profession. This study could be replicated for novice teachers.

Due to time constraints and the realities of classroom research, this study was designed to take the least amount of time away from the classroom teachers and their daily schedules. The researcher recommends that future studies include wearing the Spire for a longer baseline, intervention, post-test, and maintenance phase.

Conclusion

Simply put, novice teachers in low SES schools need to be supported and provided an avenue to effectively relieve workload stress to reduce burnout while increasing retention of our nation's teaching force. Reducing teacher stress through the use of biofeedback should, at the core, focus on ensuring every student, regardless of their diverse background, receive an education to support them in becoming a positive and contributing member of society. The data

from this study does show the need for more specific stress reducing tactics for our novice teachers. Understanding the connections between the stress novice teachers encounter on a daily basis and the support provided by administration and fellow mentors at low SES schools could lead to a positive, social change (Margolis & Nagel, 2006). The goal is to alleviate stress and burnout while enhancing teacher well-being, not only by reducing risk factors, but also by creating awareness and increasing proactive factors (Prilleltensky et al., 2016). Continuing to research biofeedback with novice teachers' in low SES schools could be a helpful tool to support awareness of tension and stress-related breathing rates to increase self-awareness and decrease stress (Burish & Jenkins, 1992; Ratanasiripong et al., 2012, Klich, 2016; Sparks, 1983; Friedman, 2000). Over time, the evolution of biofeedback devices could create more choice and more buy-in for novice teachers, while ensuring the effects of these current and future technological well-being tools endure over time (Schwartz & Andrasik, 2017) and directly impact teacher retention, ultimately improving student learning outcomes.

APPENDIX A
TEACHER STRESS INVENTORY

Good luck with your dissertation, Angelica!

Regards,

Michael

Dr. Michael J. Fimian
InstructionalTech.net
37 Gay Rd
Brookfield, MA 01506

774-200-7881
www.InstructionalTech.net

From: Angelica Fulchini [mailto:amfulchini@Knights.ucf.edu]
Sent: Monday, October 23, 2017 12:11 PM
To: Michael Fimian <Fimian@InstructionalTech.net>
Subject: Re: Use of TSI in dissertation

Yes, thank you! I wanted to make the connection through email before conducting research.

Best,

Angelica Fulchini
Doctoral Candidate
Project LEAD Scholar
TLE TeachLivE
University of Central Florida
College of Education and Human Performance
amfulchini@knights.ucf.edu
Phone: (772)473-3488

From: Michael Fimian <Fimian@InstructionalTech.net>
Date: Monday, October 23, 2017 at 10:30 AM
To: Angelica Fulchini <amfulchini@Knights.ucf.edu>
Cc: "fimian@instructionaltech.net" <Fimian@InstructionalTech.net>
Subject: RE: Use of TSI in dissertation

Sounds like an interesting project Angelica! Were you able to find the TSI page on my Website?

Regards,

Michael

Dr. Michael J. Fimian
InstructionalTech.net
37 Gay Rd
Brookfield, MA 01506

774-200-7881
www.InstructionalTech.net

From: Angelica Fulchini [mailto:amfulchini@Knights.ucf.edu]
Sent: Monday, October 23, 2017 10:15 AM
To: Fimian@InstructionalTech.net
Subject: Use of TSI in dissertation

Hello,

My name is Angelica Fulchini. I am interested in using the TSI for my dissertation in Exceptional Education at the University of Central Florida. The TSI will be used as a pretest-posttest instrument for determining novice teachers stress rates in urban inclusive elementary schools.

Best,

Angelica Fulchini

Angelica Fulchini
Doctoral Candidate
Project LEAD Scholar
TLE TeachLivE
University of Central Florida
College of Education and Human Performance
amfulchini@knights.ucf.edu

TEACHER CONCERNS INVENTORY

The following are a number of teacher concerns. Please identify those factors which cause you strss in your present position. Read each statement carefully and decide if you ever feel this way about your job. Then, indicate how strong the feeling is when you experience stress by circling the appropriate rating on the 5-point scale. If you have not experienced this feeling, or if the item is inappropriate for your position, circle number 1 (no strength; not noticeable). The rating scale is shown at the top of each page.

Examples:

I feel insufficiently prepared for my job.	1	2	3	4	5

If you feel very strongly that you are insufficiently prepared for your job, you would circle number 5.

I feel that if I step back in either effort or commitment, I may be seen as less competent.	1	2	3	4	5

If you never feel this way, and the feeling does not have noticeable strength, you would circle number 1.

How strong?	1 No strength; Not noticeable	2 Mild strength; Barely noticeable	3 Medium strength; Moderately noticeable	4 Great strength; Very noticeable	5 Major strength; Extremely noticeable

---

TIME MANAGEMENT

1. I easily over-commit myself.	1	2	3	4	5
2. I become impatient if others do things too slowly.	1	2	3	4	5
3. I have to try doing more than one thing at a time.	1	2	3	4	5
4. I have little time to relax/enjoy the time of day.	1	2	3	4	5
5. I think about unrelated matters during conversations.	1	2	3	4	5
6. I feel uncomfortable wasting time.	1	2	3	4	5
7. There isn't enough time to get things done.	1	2	3	4	5
8. I rush in my speech.	1	2	3	4	5

Add items 1 through 8; divide by 8; place your score here:

Total	Divided by 8	Final Score
	/8	

WORK-RELATED STRESSORS

9. There is little time to prepare for my lessons/responsibilities.	1	2	3	4	5
10. There is too much work to do.	1	2	3	4	5
11. The pace of the school day is too fast.	1	2	3	4	5
12. My caseload/class is too big.	1	2	3	4	5
13. My personal priorities are being shortchanged due to time demands.	1	2	3	4	5
14. There is too much administrative paperwork in my job.	1	2	3	4	5

Add items 9 through 14; divide by 6; place your score here:

Total	Divided by 6	Final Score
	/6	

PROFESSIONAL DISTRESS

15. I lack promotion and/or advancement opportunities.	1	2	3	4	5
16. I am not progressing in my job as rapidly as I would like.	1	2	3	4	5
17. I need more status and respect from my job.	1	2	3	4	5
18. I receive an inadequate salary for the work I do.	1	2	3	4	5
19. I lack recognition for the extra work and/or good teaching I do.	1	2	3	4	5

Add items 15 through 19; divide by 5; place your score here:

Total	Divided by 5	Final Score
	/5	

DISCIPLINE AND MOTIVATION

I feel frustrated...

20. ...because of discipline problems in my classroom.	1	2	3	4	5
21. ...having to monitor pupil behavior.	1	2	3	4	5
22. ...because some students would do better if they tried.	1	2	3	4	5
23. ...attempting to teach students who are poorly motivated.	1	2	3	4	5
24. ...because of inadequate/poorly defined discipline problems.	1	2	3	4	5
25. ...when my authority is rejected by pupils/administration.	1	2	3	4	5

Add items 20 through 25; divide by 6; place your score here:

Total	Divided by 6	Final Score
	/6	

PROFESSIONAL INVESTMENT

26. My personal opinions are not sufficiently aired.	1	2	3	4	5
27. I lack control over decisions made about classroom/school matters.	1	2	3	4	5
28. I am not emotionally/intellectually stimulated on the job.	1	2	3	4	5
29. I lack opportunities for professional improvement.	1	2	3	4	5

Add items 26 through 29; divide by 4; place your score here:

Total	Divided by 4	Final Score
	/4	

EMOTIONAL MANIFESTATIONS

I respond to stress...

30. ...by feeling insecure.	1	2	3	4	5
31. ...by feeling vulnerable.	1	2	3	4	5
32. ...by feeling unable to cope.	1	2	3	4	5
33. ...by feeling depressed.	1	2	3	4	5
34. ...by feeling anxious.	1	2	3	4	5

Add items 30 through 34; divide by 5; place your score here:

Total	Divided by 5	Final Score
	/5	

FATIGUE MANIFESTATIONS

I respond to stress...

35. ...by sleeping more than usual.	1	2	3	4	5
36. ...by procrastinating.	1	2	3	4	5
37. ...by becoming fatigued in a very short time.	1	2	3	4	5
38. ...with physical exhaustion.	1	2	3	4	5
39. ...with physical weakness.	1	2	3	4	5

Add items 35 through 39; divide by 5; place your score here:

Total	Divided by 5	Final Score
	/5	

CARDIOVASCULAR MANIFESTATIONS

I respond to stress...

40. ...with feelings of increased blood pressure	1	2	3	4	5
41. ...with feeling of heart pounding or racing.	1	2	3	4	5
42. ...with rapid and/or shallow breath.	1	2	3	4	5

Add items 40 through 42; divide by 3; place your score here:

Total	Divided by 3	Final Score
	/3	

GASTRONOMICAL MANIFESTATIONS

I respond to stress...

43. ...with stomach pain of extended duration.	1	2	3	4	5
44. ...with stomach cramps.	1	2	3	4	5
45. ...with stomach acid.	1	2	3	4	5

Add items 43 through 45; divide by 3; place your score here:

Total	Divided by 3	Final Score
	/3	

BEHAVIORAL MANIFESTATIONS

I respond to stress...

46. ...by using over-the-counter drugs.	1	2	3	4	5
47. ...by using prescription drugs.	1	2	3	4	5
48. ...by using alcohol.	1	2	3	4	5
49. ...by calling in sick.	1	2	3	4	5

Add items 46 through 49; divide by 4; place your score here:

Total	Divided by 4	Final Score
	/4	

TOTAL SCORE

Add all calculated scores; enter the value here _____.

Then, divide by 10; enter the Total Score here _____.

Demographic Variables

Your sex:

Number of years you have taught? _____

Your age: _____

How many students do you teach each day? _____

What level students do you teach? (circle the rest of your answers)

Elementary Middle School Secondary

With what type of students do you work with the most each day?

Students with disabilities Students without disabilities

Which is the most advanced degree you have?

Bachelors Masters Doctorate

Do you and your peers support one another when needed? Yes No

Do you and your supervisors support one another when needed? Yes No

APPENDIX B
MASLACH BURNOUT INVENTORY-EDUCATORS SURVEY

mind garden

www.mindgarden.com

To whom it may concern,

This letter is to grant permission for the above named person to use the following copyright material for his/her thesis or dissertation research:

Instrument: ***Maslach Burnout Inventory, Forms: General Survey, Human Services Survey & Educators Survey***

Copyrights:

MBI-General Survey (MBI-GS): Copyright ©1996 Wilmar B. Schaufeli, Michael P. Leiter, Christina Maslach & Susan E. Jackson. All rights reserved in all media. Published by Mind Garden, Inc., www.mindgarden.com

MBI-Human Services Survey (MBI-HSS): Copyright ©1981 Christina Maslach & Susan E. Jackson. All rights reserved in all media. Published by Mind Garden, Inc., www.mindgarden.com

MBI-Educators Survey (MBI-ES): Copyright ©1986 Christina Maslach, Susan E. Jackson & Richard L. Schwab. All rights reserved in all media. Published by Mind Garden, Inc., www.mindgarden.com

Three sample items from a single form of this instrument may be reproduced for inclusion in a proposal, thesis, or dissertation.

The entire instrument may not be included or reproduced at any time in any published material.

Sincerely,

Robert Most
Mind Garden, Inc.
www.mindgarden.com

APPENDIX C
DAILY STRESS INVENTORY

Daily Stress Survey

Name: _____

Date: _____

How stressed are you today?

1 Not Very Stressed 2 Not Stressed 3 Stressed 4 Very Stressed

If your rating was higher than a 1, what contributed to your increased stress levels today?

_____
_____
_____
_____
_____
_____

APPENDIX D
INFORMAL INTERVIEW QUESTIONS

INFORMAL INTERVIEW QUESTIONS

1.) What do you consider to be the main causes of stress during your first year(s) of teaching?
2.) Before the Spire, what strategies did you use to cope with stress? Have these coping strategies been effective? Why or why not?
3.) After the Spire, what strategies did you use to cope with stress? Have these coping strategies been effective? Why or why not?
4.) How could administration better support you throughout your first few years of teaching related to stress?
5.) What three factors contribute to your stress in the classroom? Why?
6.) What were your lived experiences with biofeedback during this study?
7.) Do you feel the Spire was an effective tool? If yes, why? If no, why not?
8.) Is there anything else you would like to share related to stress, burnout, first years of teaching or biofeedback?

APPENDIX E
INFORMED CONSENT LETTER

REDUCING TEACHER STRESS THROUGH BREATHING BIOFEEDBACK IN TITLE I ELEMENTARY SCHOOLS

Informed Consent

Principal Investigator: Angelica Fulchini, Doctoral Student

Faculty Advisor: Dr. Lisa Dieker, Ph.D.

Investigational Site(s): Elementary Schools in partnership school districts

Introduction: Researchers at the University of Central Florida (UCF) study many topics. To do this we need the help of people who agree to take part in a research study. You are being invited to take part in a research study which will include about 50 teachers in their first five years in the field. You have been asked to take part in this research study because you are a beginning teacher in a Title I elementary school teaching in an inclusive classroom. You must be 18 years of age or older to be included in this research study.

The person doing this research is a PhD. Student at the University of Central Florida in the Exceptional Education track. Because the researcher is a PhD. student, she is being guided by Lisa Dieker, Ph.D., UCF faculty advisor in Exceptional Education.

What you should know about a research study:

- Someone will explain this research study to you.
- A research study is something you volunteer for.
- Whether or not you take part is up to you.
- You should take part in this study only because you want to.
- You can choose not to take part in the research study.
- You can agree to take part now and later change your mind.
- Whatever you decide it will not be held against you.
- Feel free to ask all the questions you want before you decide.

Purpose of the research study: The purpose of this study is to evaluate the effectiveness of biofeedback on breathing rates of novice teachers in inclusive Title I classrooms to potentially decrease their stress and burnout rates.

What you will be asked to do in the study:

You will be asked to use a Spire Inc. biofeedback tracker (https://spire.io) and participate in a stress survey and burnout inventory. Day one starts with your taking the Maslach Burnout Inventory (MBI) and the Teacher Stress Inventory (TSI). Once surveys are complete, the researcher will give you the Spire to track breathing and ask that you wear it the entire day of teaching. At the end of each day, you will be asked to track your stress on the daily stress level survey from one, not very stressed, to five, very stressed. You then are asked to provide a rating for any level of stress given above a 1 as to what you perceive contributed to your stress that day.

You will be asked to continue wearing the Spire and completing the daily stress survey every day for 26 days. On day 26 the researcher will collect all Spire data and distribute the post MBI and the TSI. Once complete, all scores will be recorded with an ID number not directly associated with your name. During the last day of the intervention phase, informal interviews will take place with the research regarding your experiences and perceived outcomes of using the Spire to help you track your breathing rates over the course of the study.

Location: The researcher will go to the participant at their school.

Time required: We expect that you will be in this research study for 30 days. You will be aware of your breathing rate daily and complete a daily stress inventory (approximately 1-3 minutes to complete).

Audio or video taping:

You will be videotaped at the end of the study, day 27-30, during informal interviews. If you do not want to be videotaped, the researcher will ask to capture at least an audio recording. Discuss any concerns you have with the researcher. If you are videotaped or audiotaped, the recording will be kept in a locked, safe place. The recording will be erased or destroyed and only used for the purposes of this study, analyzed immediately after the conclusion of this study, and destroyed within five years of the completion of the study.

Risks: There are no expected risks for taking part in this study. There are no reasonably foreseeable risks or discomforts involved in taking part in this study.

Benefits: We cannot promise any benefits to you or others from your taking part in this research. However, possible benefits include reducing stress and anxiety.

Compensation or payment:

There is no compensation or other payment to you for taking part in this study.

Confidentiality: We will limit your personal data collected in this study to people who have a need to review this information. We cannot promise complete secrecy. Organizations that may inspect and copy your information include the IRB and other representatives of UCF.

Study contact for questions about the study or to report a problem: If you have questions, concerns, or complaints, or think the research has hurt you, contact Angelica Fulchini, PhD. Student, Exceptional Education, College of Education and Human Performance, [redacted] or by email at amfulchini@knights.ucf.edu.

IRB contact about your rights in the study or to report a complaint: Research at the University of Central Florida involving human participants is carried out under the oversight of the Institutional Review Board (UCF IRB). This research has been reviewed and approved by the IRB. For information about the rights of people who take part in research, please contact: Institutional Review Board, University of Central Florida, Office of Research & Commercialization, 12201 Research Parkway, Suite 501, Orlando, FL 32826-3246 or by telephone at (407) 823-2901. You may also talk to them for any of the following:

- Your questions, concerns, or complaints are not being answered by the research team.
- You cannot reach the research team.
- You want to talk to someone besides the research team.
- You want to get information or provide input about this research.

Your signature below indicates your permission to take part in this research.

DO NOT SIGN THIS FORM AFTER THE IRB EXPIRATION DATE BELOW

Name of participant	
Signature of participant	Date
Signature of person obtaining consent	Date
Printed name of person obtaining consent	

APPENDIX F
STUDY BROCHURE

Spire: Unlock the Power of Breathing to Reduce Stress

What you will be asked to do in the study:

You will be asked to use a Spire Inc. biofeedback tracker and participate in a stress survey and burnout inventory.

How Spire Works:

"Spire is designed to help you keep in sync with your mind and body by measuring your breathing, all-day, and alerting you to sudden changes." (Spire, 2018)

The biofeedback device measures your breathing via the expansion and contraction of your torso.

Why Measure my Breathing?

Spire will be used in this study to evaluate the effectiveness of biofeedback on breathing rates of novice teachers in inclusive low SES classrooms to potentially decrease stress and burnout rates.

The Spire app analyzes and categorizes your breathing as calm, tense, or focused (Spire, 2018).

See your Breathing in Real Time

Notifications alert you of tense breathing changes so that you can become more aware of your breathing and reset your breath.

Follow your Breathwave, in real time view, on the Spire home screen (Spire, 2018).

APPENDIX G
UCF OUTCOME LETTER

University of Central Florida Institutional Review Board
Office of Research & Commercialization
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246
Telephone: 407-823-2901 or 407-882-2276
www.research.ucf.edu/compliance/irb.html

Approval of Human Research

From: **UCF Institutional Review Board #1**
FWA00000351, IRB00001138

To: **Angelica M Fulchini**

Date: **February 02, 2018**

Dear Researcher:

On 02/02/2018 the IRB approved the following modifications / human participant research until 02/01/2019 inclusive:

Type of Review:	Submission Correction for UCF Initial Review Submission Form Expedited Review Category #6 and #7 Adult Participants, N=50
Project Title:	REDUCING TEACHER STRESS THROUGH BREATHING BIOFEEDBACK IN TITLE I ELEMENTARY SCHOOLS
Investigator:	Angelica M Fulchini
IRB Number:	SBE-17-13670
Funding Agency:	
Grant Title:	
Research ID:	N/A

The scientific merit of the research was considered during the IRB review. The Continuing Review Application must be submitted 30days prior to the expiration date for studies that were previously expedited, and 60 days prior to the expiration date for research that was previously reviewed at a convened meeting. Do not make changes to the study (i.e., protocol, methodology, consent form, personnel, site, etc.) before obtaining IRB approval. A Modification Form **cannot** be used to extend the approval period of a study. All forms may be completed and submitted online at https://iris.research.ucf.edu .

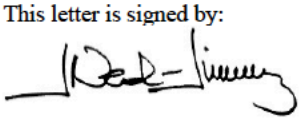
If continuing review approval is not granted before the expiration date of 02/01/2019, approval of this research expires on that date. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

Use of the approved, stamped consent document(s) is required. Your consent documents include the Spire brochure. The new form supersedes all previous versions, which are now invalid for further use. Only approved investigators (or other approved key study personnel) may solicit consent for research participation. Participants or their representatives must receive a signed and dated copy of the consent form(s).

All data, including signed consent forms if applicable, must be retained and secured per protocol for a minimum of five years (six if HIPAA applies) past the completion of this research. Any links to the identification of participants should be maintained and secured per protocol. Additional requirements may be imposed by your funding agency, your department, or other entities. Access to data is limited to authorized individuals listed as key study personnel.

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

This letter is signed by:



Signature applied by Jennifer Neal-Jimenez on 02/02/2018 09:18:30 PM EST

Designated Reviewer

REFERENCES

Ahlquist, R. (1991). Position and imposition: Power relations in a multicultural foundations class. *The Journal of Negro Education*, *60*(2), 158–169.

Atkins, M. S., Graczyk, P. A., Frazier, S. L., & Abdul-Adil, J. (2003). Toward a new model for promoting urban children's mental health: Accessible, effective, and sustainable school-based mental health services. *School Psychology Review*, *32*(4), 503-514.

Atteberry, A., Loeb, S., & Wyckoff, J. (2017). Teacher churning: Reassignment rates and implications for student achievement. *Educational Evaluation and Policy Analysis*, *39*(1), 3–30.

Bales, B. L. (2006). Teacher education policies in the United States: The accountability shift since 1980. *Teaching and Teacher Education*, *22*(4), 395-407.

Barnes, G., Crowe, B., & Schaefer, E. (2007). *The cost of teacher turnover in five school districts: A pilot study*. Washington, DC: National Commission on Teaching and America's Future.

Bayar, A. (2014). The components of effective professional development activities in terms of teachers' perspective. *International Online Journal of Educational Sciences*, *6*(2), 319-327.

Beehr, T. A., & Newman, J. E. (1978). Job stress, employee health, and organizational effectiveness: A facet analysis, model, and literature review. *Personnel psychology*, *31*(4), 665-699.

Benson, H., & Stuart, E. M. (1993). *The wellness book: The comprehensive guide to maintaining health and treating stress-related illness.* Simon And Schuster.

Blanchett, W. J., Mumford, V., & Beachum, F. (2005). Urban school failure and disproportionality in a post-Brown era. *Remedial and Special Education, 26*(2), 70–81. Retrieved from http://rse.sagepub.com/content/26/2/70.short

Bondy, E., Ross, D. D., Gallingane, C., & Hambacher, E. (2007). Creating environments of success and resilience: Culturally responsive classroom management and more. *Urban Education, 42*(1), 326–348.

Boyd, W. L., & Shouse, R. C. (1997). The problems and promise of urban schools. In H. J. Walberg, O. Reyes, R. P. Weissberg, H. J. Walberg, O. Reyes, & R. P. Weissberg (Eds.), *Children and youth: Interdisciplinary perspectives.* (pp. 141–165). Thousand Oaks, CA: Sage Publications, Inc.

Boyle, G., Borg, M., Falzon, J., & Baglioni, A. (1995). A structural model of the dimensions of teacher stress. *The British Journal of Educational Psychology*, *65*(49), 49–67.

Bergeron, B. S. (2008). Enacting a culturally responsive curriculum in a novice teacher's classroom: encountering disequilibrium. *Urban Education, 43*(1), 4–28.

Brophy, J. (1981). Teacher praise: A functional analysis. *Review of Educational Research*, *51*(1), 5-32.

Brown, F. (2004). The first serious implementation of brown : The 1964 civil rights act and beyond, *Journal of Negro Education*, *73*(3), 182–190.

Bruin, E. I., Zwan, J. E., & Bogels, S. M. (2016). A RCT comparing daily mindfulness meditations, biofeedback exercises, and daily physical exercise on attention control, executive functioning, mindful awareness, self-compassion, and worrying in stressed young adults. *Mindfulness, 5*(1). 1182-1185.

Burish, T. G., & Jenkins, R. A. (1992). Effectiveness of biofeedback and relaxation training in reducing the side effects of cancer chemotherapy. *Health Psychology*, *11*(1), 17-23.

Calderon, K. S., & Thompson, W. W. (2004). Biofeedback relaxation training: A rediscovered mind-body tool in public health. *American Journal of Health Studies*, *19*(4), 185-194.

Call, D., Miron, L., & Orcutt, H. (2014). Effectiveness of brief mindfulness techniques in reducing symptoms of anxiety and stress. *Mindfulness*, *5*(6), 658-668.

Council for the Accreditation of Educator Preparation. (2013). Council for the accreditation of educator preparation report to the public, the states, the policymakers, and the education profession. Retrieved from http://caepnet.org/~/media/Files/caep/standards/caep-standards-one-pager-061716.pdf?la=en

Cappella, E., Frazier, S. L., Atkins, M. S., Schoenwald, S. K., & Glisson, C. (2008). Enhancing schools' capacity to support children in poverty: An ecological model of school-based mental health services. *Administration and Policy in Mental Health and Mental Health Services Research*, *35*(5), 395-409.

Carver-Thomas, D., & Darling-Hammond, L. (2017). *Teacher turnover: Why it matters and what we can do about it.* Palo Alto, CA: Learning Policy Institute.

Carver, C. S., & Connor-Smith, J. (2010). Personality and coping. *Annual Review of Psychology*, *61*(1), 679–704.

Caspersen, J., & Raaen, F. D. (2014). Novice teachers and how they cope. *Teachers and Teaching*, *20*(2), 189-211.

Castro, A. J., Kelly, J., & Shih, M. (2010). Resilience strategies for new teachers in high-needs areas. *Teaching and Teacher Education*, *26*(3), 622–629.

Chang, M. L. (2009). An appraisal perspective of teacher burnout: Examining the emotional work of teachers. *Educational psychology review*, *21*(3), 193-218.

Chester, M. D., & Beaudin, B. Q. (1996). Efficacy beliefs of newly hired teachers in urban schools. *American Educational Research Journal*, *33*(1), 233–257.

Clotfelter, C. T., Ladd, H. F., & Vigdor, J. (2005). Who teaches whom? Race and the distribution of novice teachers. *Economics of Education Review*, *24*(4), 377–392.

Cochran-Smith, M. (1995). Color blindness and basket making are not the answers: Confronting the dilemmas of race, culture, and language diversity in teacher education. *American Educational Research Journal*, *32*(3), 493–522.

Cochran-Smith, M., & Fries, K. (2005). Researching Teacher Education in Changing Times: Politics and Paradigms. In M. Cochran-Smith, K. M. Zeichner, M. Cochran-Smith, K. M. Zeichner (Eds.) , *Studying teacher education: The report of the AERA Panel on Research and Teacher Education* (pp. 69-109). Mahwah, NJ, US; Washington, DC, US: Lawrence Erlbaum Associates Publishers.

Cochran-Smith, M., & Lytle, S. (2006). Troubling images of teaching in no child left behind. *Harvard Educational Review*, *76*(4), 668-697.

Coakley, J. (1992). Burnout among adolescent athletes: A personal failure or social problem? *Sociology of sport journal*, *9*(3), 271-285.

Cooper, C., & Travers, C. (2012). *Teachers under pressure: Stress in the teaching profession*. Routledge.

Conroy, M. A., Sutherland, K. S., Snyder, A., Al-Hendawi, M., & Vo, A. (2009). Creating a positive classroom atmosphere: Teachers' use of effective praise and feedback. *Beyond Behavior*, *18*(2), 18-26.

Creswell, J. W., & Clark, V. L. P. (2007). Designing and conducting mixed methods research. Thousand Oaks, CA: Sage.

Croft, S. J., Roberts, M. A., & Stenhouse, V. L. (2016). The perfect storm of education reform: High-stakes testing and teacher evaluation. *Social Justice*, *42*(1), 70-92.

Cuban, L. (1993). *How teachers taught: Constancy and change in American classrooms, 1890-1990*. Teachers College Press.

Darling-Hammond, L. (1999). Target time toward teachers. *Journal of Staff Development*, *20*(2), 31–36.

Darling-Hammond, L. (2000). How teacher education matters. *Journal of Teacher Education*, *51*(3), 166-173.

Darling-Hammond, L. (2006). Constructing 21st-century teacher education. *Journal of Teacher Education*, *57*(3), 300-314.

Darling-Hammond, L. (2007). Race, inequality and educational accountability: The irony of 'No Child Left Behind'. *Race Ethnicity and Education*, *10*(3), 245-260.

Darling-Hammond, L. (2010a). Recruiting and retaining teachers: Turning around the race to the bottom in high-need schools. *Journal of Curriculum and Instruction*, *4*(1), 16–32.

Darling-Hammond, L. (2010b). Teacher education and the American future. *Journal of Teacher Education* , *61*(1–2), 35–47. https://doi.org/10.1177/0022487109348024

Darling-Hammond, L. (2016). Research on teaching and teacher education and its influences on policy and practice. *Educational Researcher*, *45*(2), 83-91.

Darling-Hammond, L., & Bransford, J. (2005). Preparing teachers for a changing world: Report of the committee on teacher education of the national academy of education. San Francisco, CA: Jossey-Bass.

Darling-Hammond, L., & Berry, B. (2006). Highly qualified teachers for all. *Educational Leadership*, *64*(3), 14-20.

Darling-Hammond, L., & Sykes, G. (2003). Wanted, a national teacher supply policy for education: The right way to meet the“ highly qualified teacher” challenge. *Education Policy Analysis Archives*, *11*(33), 1-55.

Darling-Hammond, L., & Youngs, P. (2002). Defining “highly qualified teachers”: What does “scientifically-based research” actually tell us?. *Educational researcher*, *31*(9), 13-25.

Davidson, R., Kabat-Zinn, J., Schumacher, J., Rosenkranz, M., Muller, D., Santorelli, S., … Sheridan, J. (2003). Alterations in brain and immune function produced by mindfulness meditation. *Psychosomatic Medicine*, *65*(4), 564–570.

Day, C., & Gu, Q. (2007). Variations in the conditions for teachers' professional learning and development: Sustaining commitment and effectiveness over a career. *Oxford Review of Education*, *33*(4), 423-443.

Day, C., & Hong, J. (2016). Influences on the capacities for emotional resilience of teachers in schools serving disadvantaged urban communities: Challenges of living on the edge. *Teaching and Teacher Education*, *59*(1), 115–125. https://doi.org/10.1016/j.tate.2016.05.015

Day, G. (1998). Stress prevention, not cure. *The Director*, *52*(4), 46-58.

Dewey, J. (1916). Democracy and education. New York, NY: The Macmillan Company.

Dicke, T., Elling, J., Schmeck, A., & Leutner, D. (2015). Reducing reality shock: The effects of classroom management skills training on beginning teachers. *Teaching and Teacher Education, 48*(1), 1-12.

Donaldson, M. L. (2009). Into—and out of—city schools: The retention of teachers prepared for urban settings. *Equity & Excellence in Education, 42*(3), 347–370.

Duncan, G., & Magnuson, K. (2005). Can family socioeconomic resources account for racial and ethnic test score gaps? *The Future of Children, 15*(1), 35-54.

Farber, B. (1982). Teacher burnout: Assumptions, myths, and issues. *Teachers College Record*, *86*(2), 321–338.

Fimian, M. J. (1988). The alpha and split-half reliability of the teacher stress inventory. *Psychology in the Schools, 25*(2), 110-118.

Fimian, M. J. (1986). Social support and occupational stress in special education. *Exceptional Children, 52*(5), 436–442.

Fimian, M. J., & Blanton, L. P. (1987). Stress, burnout, and role problems among teacher trainees and first-year teachers. *Journal of Organizational Behavior*, *8*(2), 157–165.

Fimian, M. J., & Fastenau, P. S. (1990). The validity and reliability of the Teacher Stress Inventory: A re-analysis of aggregate data. *Journal of Organizational Behavior*, *11*(2), 151–157.

Floden, R., Goertz, M., & O'Day, J. (1995). Capacity building in systemic reform. *The Phi Delta Kappan*, *77*(1), 19–21. Retrieved from http://www.jstor.org/stable/20342865

Flook, L., Goldberg, S. B. ., Pinger, L., Bonus, K., & Davidson, R. J. (2013). Mindfulness for teachers: A pilot study to assess effects on stress, burnout, and teaching efficacy. *Mind, Brain & Education*, *7*(3), 182–195. Retrieved from http://10.0.4.87/mbe.12026

Frank, J. L., Reibel, D., Broderick, P., Cantrell, T., & Metz, S. (2015). The effectiveness of mindfulness-based stress reduction on educator stress and well-being: Results from a pilot study. *Mindfulness*, *6*(2), 208-216.

Friedman, I. A. (2000). Burnout in teachers: Shattered dreams of impeccable professional performance. *Journal of Clinical Psychology, 56*(5), 595-606.

Gaillard, A. W. K., & Wientjes, C. J. E. (1994). Mental load and work stress as two types of energy mobilization. *Work & Stress*, *8*(2), 141–152.

Gall, M. D., Gall, J. P., & Borg, W. R. (2007). *Educational research: An introduction*. New York, NY: Person Education, Inc.

Gast, D. L., & Ledford, J. R. (2014). *Single case research methodology: Applications in special education and behavioral sciences.* New York, NY: Routledge.

Gelder, M., Gath, D., & Mayou, R. (1989). *Oxford textbook of psychiatry*. New York, NY: Oxford University Press.

Glaser, B., & Strauss, A. (1967). Grounded theory: The discovery of grounded theory. *Sociology The Journal Of The British Sociological Association, 12*(1), 27–49.

Goetz, J. L., Keltner, D., & Simon-Thomas, E. (2010). Compassion: an evolutionary analysis and empirical review. *Psychological Bulletin, 136*(3), 351.

Grant, C.A., & Secada, W.G. (1990). Preparing teachers for diversity. In W. R. Houston, M. Haberman , & J. Sikula (Eds.), *Handbook of research on teacher education* (pp. 403-422). Old Tappan, NJ: Macmillan.

Gray, L., & Taie, S. (2015). Public school teacher attrition and mobility in the first five years: Results from the first through fifth waves of the 2007-08 beginning teacher longitudinal study. First look. NCES 2015-337. *National Center for Education Statistics*.

Grissom, J. A. (2011). Can good principals keep teachers in disadvantaged schools? Linking principal effectiveness to teacher satisfaction and turnover in hard-to-staff environments. *Teachers College Record, 113*(11), 2552–2585.

Guarino, C. M., Santibanez, L., & Daley, G. A. (2006). Teacher recruitment and retention: A review of the recent empirical literature. *Review of Educational Research, 76*(2), 173–208.

Guha, R., Hyler, M. E., & Darling-Hammond, L. (2017). The power and potential of teacher residencies. *Phi Delta Kappan, 98*(8), 31-37.

Hall, D. 2007. *Graduation matters: Increasing accountability for high school graduation*. Washington, DC: Education Trust.

Hallgren, K. A. (2012). Computing inter-rater reliability for observational data: An overview and tutorial. *Tutorials in Quantitative Methods for Psychology, 8*(1), 23–34.

Hamre, B. K., & Pianta, R.C. (2005). Can instructional and emotional support in the first-grade classroom make a difference for children at risk of school failure? *Child Development, 76*(5), 949-967.

Hamre, B. K., Pianta, R. C., Downer, J. T., & Mashburn, A. J. (2008). Teachers' perceptions of conflict with young students: Looking beyond problem behaviors. *Social Development, 17*(1), 115–136.

Hastings, R. P., Horne, S., & Mitchell, G. (2004). Burnout in direct care staff in intellectual disability services: A factor analytic study of the Maslach Burnout Inventory. *Journal of Intellectual Disability Research, 48*(3), 268–273.

Hartney, E. (2008). *Stress management for teachers.* New York, NY: Continuum.

Harris, A. R., Jennings, P. A., Katz, D. A., Abenavoli, R. M., & Greenberg, M. T. (2016). Promoting stress management and wellbeing in educators: Feasibility and efficacy of a school-based yoga and mindfulness intervention. *Mindfulness*, *7*(1), 143-154.

Hawkins, M. R. (2011). *Social justice language teacher education*. Tonawanda, NY: Multilingual Matters.

Hayes, S. C., Luoma, J. B., Bond, F. W., Masuda, A., & Lillis, J. (2006). Acceptance and commitment therapy: Model, processes, and outcomes. *Behaviour Research and Therapy, 44*(1), 1-25.

Headden, S. (2014). *Beginners in the classroom: What the changing demographics of teaching mean for schools, students, and society*. Stanford, CA: Carnegie Foundation for the Advancement of Teaching.

Herman, K., & Reinke, W. (2015). *Stress management for teachers: A proactive guide.* New York, NY: Guilford.

Hitz, R., & Driscoll, A. (1988). Praise or encouragement? New insights into praise: Implications for early childhood teachers. *Young Children, 43*(5), 6-13.

Hodge, G. M., Jupp, J. J., & Taylor, A. J. (1994). Work stress, distress and burnout in music and mathematics teachers. *British Journal of Educational Psychology, 64*(1), 65–76.

Hofmann, S. G., Sawyer, A. T., Witt, A. A., & Oh, D. (2010). The effect of mindfulness-based therapy on anxiety and depression: A meta-analytic review. *Journal of Consulting and Clinical Psychology, 78*(2), 169-183.

Holmes, T. H., & Rahe, R. H. (1967). The social readjustment rating scale. *Journal of Psychosomatic Research, 11*(2), 213–218.

Holloway, J. (2001). The benefits of mentoring. *Educational Leadership, 58*(1), 85–86.

Hughes, R. E. (2001). Deciding to leave but staying: teacher burnout, precursors and turnover. *International Journal of Human Resource Management, 12*(2), 288-298.

Ingersoll, R. M. (1995). *Teacher supply, teacher qualifications, and teacher turnover: 1990-91. Schools and Staffing Survey.* ERIC.

Ingersoll, R. M. (2009). *Who controls teachers' work?: Power and accountability in America's schools*. Harvard University Press.

Ingersoll, R., & Kralik, J. M. (2004). *The impact of mentoring on teacher retention: What the research says.* Denver, CO: Education Commission of the States.

Ingersoll, R. M., & Smith, T. M. (2003). The wrong solution to the teacher shortage. *Educational Leadership, 60*(8), 30-33.

Ingersoll, R. M., & Strong, M. (2011). The impact of induction and mentoring programs for beginning teachers: A critical review of the research. *Review of Educational Research, 81*(2), 201-233.

Isenbarger, L., & Zembylas, M. (2006). The emotional labor of caring in teaching. *Teaching and Teacher Education, 22*(1), 120-134.

Jackson, S. E., Schwab, R. L., & Schuler, R. S. (1986). Toward an understanding of the burnout phenomenon. *Journal of Applied Psychology, 71*(4), 630-640.

Jacob, A., Vidyarthi, E., & Carroll, K. (2012). *The irreplaceables: Understanding the real retention crisis in america's urban schools.* New York, NY: The New Teacher Project.

Jacob, B. A. (2007). A Portrait of Urban Districts. *Future of Children, 17*(1), 129–153.

Jennings, P. A., & DeMauro, A. A. (2017). Individual-Level Interventions: Mindfulness-Based Approaches to Reducing Stress and Improving Performance Among Teachers. In *Educator Stress* (pp. 319-346). Springer, Cham.

Jennings, P. A., & Greenberg, M. T. (2009). The prosocial classroom: teacher social and emotional competence in relation to student and classroom outcomes. *Review of Educational Research, 79*(1), 491-525.

Kabat-Zinn, J. (1982). An outpatient program in behavioral medicine for chronic pain patients based on the practice of mindfulness meditation: Theoretical considerations and preliminary results. *General Hospital Psychiatry, 4*(1), 33–47.

Kabat-Zinn, J. (2003). Mindfulness-based interventions in context: Past, present, and future. *Clinical Psychology: Science and Practice, 10*(2), 144-156.

Kagan, D. M. (1992). Professional growth among preservice and beginning teachers. *Review of Educational Research, 62*(1), 129–169.

Kailin, J. (1994). Anti-racist staff development for teachers: Considerations of race, class, and gender. *Teaching and Teacher Education, 10*(2), 169–184.

Kataoka, S. H., Zhang, L., & Wells, K. B. (2002). Unmet need for mental health care among U.S. children: variation by ethnicity and insurance status. *American Journal of Psychiatry*, *159*(9), 1548-1555.

Kavale, K. A., & Forness, S. R. (2000). History, rhetoric, and reality: Analysis of the inclusion debate. *Remedial and Special Education, 21*(5), 279–296.

Keaton, P. (2012). Numbers and types of public elementary and secondary schools from the common core of data: School year 2010-11. First Look. NCES 2012-325. *National Center for Education Statistics*.

Kennedy, M. M. (2016). How does professional development improve teaching?. *Review of Educational Research*, *86*(4), 945-980.

Kennedy, J. J., & Pretorius, M. (2008). Integrating a portable biofeedback device into call centre environments to reduce employee stress: Results from two pilot studies. *Journal of Workplace Behavioral Health*, *23*(3), 295-307.

Kelling, C., Pitaro, D., & Rantala, J. (2016). Good vibes: The impact of haptic patterns on stress levels. In *Proceedings of the 20th International Academic Mindtrek Conference* (pp. 130–136).

Klich, U. (2015). The integration of mindfulness-based biofeedback and compassion in the healthcare setting. *Biofeedback*, *43*(3), 111-116.

Klich, U. (2016). Clinical use of self-compassion within mindfulness-based biofeedback in the treatment of veterans and spouses: A case study. *Biofeedback*, *44*(3), 138-144.

Kozol, J. (2005). *The shame of the nation: The restoration of apartheid schooling in America*. New York, NY: Crown Publishing.

Kyriacou, C. (2001). Teacher stress: Directions for future research. *Educational review, 53*(1), 27-35.

Kyriacou, C., & Sutcliffe, J. (1978). A model of teacher stress. *Educational studies, 4*(1), 1-6.

Kwakman, K. (2003). Factors affecting teachers' participation in professional learning activities. *Teaching and teacher education, 19*(2), 149-170.

Ladson-Billings, G. (1995). Toward a theory of culturally relevant pedagogy. *American Educational Research Journal*, *32*(3), 465–491. https://doi.org/10.2307/1163320

Ladson-Billings, G. (2006). From the achievement gap to the education debt: Understanding achievement in US schools. *Educational Researcher*, *35*(7), 3–12.

Ladson-Billings, G. J. (1999). Preparing teachers for diverse student populations: A critical race theory perspective. *Review of Research in Education*, *24*(1), 211–247.

Ladson-Billings, G., & Tate IV, W. F. (1995). Toward a critical race theory of education. *Teachers College Record, 97*(1), 47-68.

Lambert, R. G., McCarthy, C., O'Donnell, M., & Wang, C. (2009). Measuring elementary teacher stress and coping in the classroom: Validity evidence for the classroom appraisal of resources and demands. *Psychology in the Schools*, *46*(10), 973–988.

Langley, A. K., Nadeem, E., Kataoka, S. H., Stein, B. D., & Jaycox, L. H. (2010). Evidence-based mental health programs in schools: Barriers and facilitators of successful implementation. *School Mental Health*, *2*(3), 105–113.

Larson, M., Cook, C. R., Fiat, A., & Lyon, A. R. (2018). Stressed teachers don't make good implementers: Examining the interplay between stress reduction and intervention fidelity. *School Mental Health, 10*(1), 61-76.

Lazarus, R. S., & Folkman, S. (1984). Coping and Adaptation. In W. D. Gentry, The Handbook of Behavioral Medicine (pp. 282-325.). New York, NY: Guilford.

Lazarus, R. S. (2006). Emotions and interpersonal relationships: Toward a person-centered conceptualization of emotions and coping. *Journal of Personality*, *74*(1), 9–46.

Liebman, J. S. (1990). Implementing brown in the nineties: Political reconstruction, liberal recollection, and litigatively enforced legislative reform. *Virginia Law Review*, *76*(1), 349-435.

Lester, N. B., & Onore, C. S. (1990). *Learning change : One school district meets language across the curriculum.* Portsmouth, NH : Boynton/Cook Publishers.

Lewis, B. A., Napolitano, M. A., Buman, M. P., Williams, D. M., & Nigg, C. R. (2017). Future directions in physical activity intervention research: expanding our focus to sedentary behaviors, technology, and dissemination. *Journal of Behavioral Medicine, 40*(1), 112-126.

Li-Grining, C., Raver, C. C., Champion, K., Sardin, L., Metzger, M. W., & Jones, S. M. (2010). Understanding and improving classroom emotional climate in the "real world": The role of teachers' psychosocial stressors. *Early Education and Development, 21*(1), 65–94.

Liu, X. S., & Ramsey, J. (2008). Teachers' job satisfaction: Analyses of the teacher follow-up survey in the United States for 2000–2001. *Teaching and Teacher Education, 24*(5), 1173–1184.

Martin, E. W., & Terman, D. L. (1996). The legislative and litagation history of special education. *The Future of Children, 6*(1), 25–39. Retrieved from http://www.tdsb.on.ca/wwwdocuments/programs/Equity_in_Education/docs/Achieving Equity in Special Education History, Status, and Current Challanges.pdf

Marzano, R. J., Marzano, J. S., & Pickering, D. (2003). *Classroom management that works : Research-based strategies for every teacher*. Alexandria, VA: Assoc. for Supervision and Curriculum Development.

Mashburn, A. J., Hamre, B. K., Downer, J. T., & Pianta, R. C. (2006). Teacher and classroom characteristics associated with teachers' ratings of prekindergartners' relationships and behaviors. *Journal of Psychoeducational Assessment*, *24*(1), 367–380.

Maslach, C., & Jackson, S. E. (1981). The measurement of experienced burnout. *Journal of Organizational Behavior*, *2*(2), 99–113.

Maslach, C., Jackson, S. E., & Leiter, M. P. (2006). *Maslach Burnout Inventory*. Palo Alto, CA: Consulting Psychologist Press.

Maslach, C., Jackson, S. E., & Schwab, R. L. (1986). *The Maslach Burnout Inventory, 2nd edition.* Palo Alto, CA: Consulting Psychologist Press.

Maslach, C., Schaufeli, W. B., & Leiter, M. P. (2001). Job burnout. *Annual Review of Psychology*, *52*(1), 397–422.

McLean, L., & Connor, C. M. (2015). Depressive symptoms in third-grade teachers: Relations to classroom quality and student achievement. *Child development*, *86*(3), 945-954.

McCann, T. M., Johannessen, L. R., & Ricca, B. (2005). *Supporting beginning English teachers: Research and implications for teacher induction*. Urbana, IL: National Council of Teachers of English.

McKinney, S. E., Haberman, M., Stafford-Johnson, D., & Robinson, J. (2008). Developing teachers for high-poverty schools: The role of the internship experience. *Urban Education*, *43*(1), 68–82.

McLeskey, J., Barringer, M-D., Billingsley, B., Brownell, M., Jackson, D., Kennedy, M., Lewis, T., Maheady, L., Rodriguez, J., Scheeler, M. C., Winn, J., & Ziegler, D. (2017). High-leverage practices in special education. Arlington, VA: Council for Exceptional Children & CEEDAR Center.

McLaurin, S. E., Smith, W., & Smillie, A. (2009). Teacher retention: Problems and solutions. *Online Submission*. ERIC.

McNeil, L. M. (1982). *Contradictions of control: the organizational context of school knowledge. Final report of "The Institutional Context Controlling Classroom Knowledge."* Madison, WI: Wisconsin Center for Public Policy.

Meiklejohn, J., Phillips, C., Freedman, M. L., Griffin, M. L., Biegel, G., Roach, A., … Isberg, R. (2012). Integrating mindfulness training into K-12 education : Fostering the resilience of teachers and students. *Mindfulness*, *3*(4), 291–307. https://doi.org/10.1007/s12671-012-0094-5

Merriam, S. B. (2002). *Qualitative research in practice: Examples for discussion and analysis.* San Franisco, CA: Jossey-Bass.

Montgomery, C., & Rupp, A. (2005). A meta-analysis for exploring the diverse causes and effects of stress in teachers. *Canadian Journal of Education / Revue Canadienne de L'éducation*, *28*(3), 458-468. https://doi.org/10.2307/4126479

Moraveji, N., Santoro, E., Smith, E., Kane, A., Crum, A., & Susi, M. (2017). Using a wearable health tracker to improve health and wellbeing under stress. In *36th Anxiety and Depression Association of America's conference*.

Morgan, S. J., & Mora, J. A. M. (2017). Effect of heart rate variability biofeedback on sport performance, a systematic review. *Applied psychophysiology and biofeedback*, 42(3), 235-245.

Murphy, L. R. (1996). Stress management in work settings: a critical review of the health effects. *American Journal Of Health Promotion: AJHP*, *11*(2), 112–135.

Neff, K. D. (2003). The development and validation of a scale to measure self-compassion. *Self & Identity*, *2*(3), 223-250. Retrieved from https://login.ezproxy.net.ucf.edu/login?auth=shibb&url=http://search.ebscohost.com/login.aspx?direct=true&db=aph&AN=10182182&site=eds-live&scope=site

Olson, L., & Larson, A. (1970). Compensatory programs and special education: Is there an alliance? *The Journal of Negro Education*, *39*(2), 180-183. https://doi.org/10.2307/2966846

Orfield, G. (1969). *The reconstruction of Southern education; the schools and the 1964 Civil rights act.* New York, NY: Wiley-Interscience.

Orfield, G. & Lee, C. (2005). *Why segregation matters: Poverty and educational inequality.* Cambridge, MA: Harvard University, The Civil Rights Project.

Ouellette, R. R., Frazier, S. L., Shernoff, E. S., Cappella, E., Mehta, T. G., Maríñez-Lora, A., & ... Atkins, M. S. (2017). Teacher job stress and satisfaction in urban schools: Disentangling individual-, classroom-, and organizational-level influences. *Behavior Therapy*, (in press), 1-15.

Parmenter, T. (1970). Power to the people through Title I? Maybe. *Inequality in Education*, *6*(1), 1-8.

Parsonson, B. S., & Baer, D. M. (1978). The analysis and presentation of graphic data. In T. Kratchowill (Ed.) *Single-subject research: Strategies for evaluating change (pp. 105–165).* New York, NY: Academic Press.

Perda, D. (2013). *Transitions into and out of teaching: A longitudinal analysis of early career teacher turnover*. ProQuest LLC.

Perry, F. D., Shaw, L., & Zaichkowsky, L. (2011). Biofeedback and neurofeedback in sports. *Biofeedback*, *39*(3), 95-100.

Pithers, R. T. (1995). Teacher stress research: Problems and progress. *British Journal of Educational Psychology*, *65*(4), 387-392.

Plarre, K., Raij, A., Hossain, S. M., Ali, A. A., Nakajima, M., Al'absi, M., … Scott, M. (2011). Continuous inference of psychological stress from sensory measurements collected in the natural environment. In *Information Processing in Sensor Networks (IPSN), 2011 10th International Conference on* (pp. 97–108). IEEE.

Podolsky, A., Kini, T., Bishop, J., & Darling-Hammond, L. (2017). Sticky schools: How to find and keep teachers in the classroom: to improve teacher recruitment, performance, and retention, education policymakers should consider five proven strategies. *Phi Delta Kappan*, *98*(8), 19-25.

Prilleltensky, I., Neff, M., & Bessell, A. (2016). Teacher stress: What it is, why it's important, how it can be alleviated. *Theory Into Practice*, *55*(2), 104-111.

Quartz, K. H., & Group, T. E. P. R. (2003). " Too angry to leave" supporting new teachers' commitment to transform urban schools. *Journal of Teacher Education*, *54*(2), 99–111.

Ratanasiripong, P., Ratanasiripong, N., & Kathalae, D. (2012). Biofeedback intervention for stress and anxiety among nursing students: A randomized controlled trial. *International Scholarly Research Network Nursing, 2012(1), 1-5.*

Ratanasiripong, P., Park, J. F., Ratanasiripong, N., & Kathalae, D. (2015). Stress and anxiety management in nursing students: Biofeedback and mindfulness meditation. *Journal of Nursing Education, 54*(9), 520-524.

Ransford, C. R., Greenberg, M. T., Domitrovich, C. E., Small, M., & Jacobson, L. (2009). The role of teachers' psychological experiences and perceptions of curriculum supports on the implementation of a social and emotional learning curriculum. *School Psychology Review, 38*(4), 510-532.

Ravitch, D. (2016). *The death and life of the great American school system: How testing and choice are undermining education*. Basic Books.

Reiner, R. (2008). Integrating a portable biofeedback device into clinical practice for patients with anxiety disorders: Results of a pilot study. *Applied Psychophysiology and Biofeedback, 33*(1), 55–61.

Richards, S. B., Taylor, R. L., Ramasamy, R., & Richards, R. Y. (1999). *Single subject research.* San Diego, CA: Singular.

Rivkin, S. G., Hanushek, E. A., & Kain, J. F. (2005). Teachers, schools, and academic achievement. *Econometrica, 73*(2), 417–458.

Robertson, M. (2008). Why novice teachers leave. *Principal Leadership, 6*(1), 33–36.

Rose, M. (2011). The mismeasure of teaching and learning: How contemporary school reform fails the test. *Dissent, 58*(2), 32–38.

Ross, Romer, & Horner. (2012). Teacher well-being and the implementation of school-wide positive behavior interventions and supports. *Journal of Positive Behavior Interventions. 14*(2), 118-128.

Roth, D., & Swail, W. S. (2000). C*ertification and teacher preparation in the United States.* Honolulu, HI: Pacific Resources for Education and Learning. Retrieved from http://www.pre.org/media/140135/98-certification_systems.pdf

Rothstein, R., & Wilder, T. (2005). *The many dimensions of racial inequality.* Paper presented at the Social Costs of Inadequate Education Symposium. Teacher College, Columbia University, New York.

Russell, D. W., Altmaier, E., & Van Velzen, D. (1987). Job-related stress, social support, and burnout among classroom teachers. *Journal of Applied Psychology, 72*(2), 269-274.

Ryan, S. V., Nathaniel, P., Pendergast, L. L., Saeki, E., Segool, N., & Schwing, S. (2017). Leaving the teaching profession: The role of teacher stress and educational accountability policies on turnover intent. *Teaching and Teacher Education, 66(*1), 1-11.

Schafer, W. E. (1997). Religiosity, spirituality, and personal distress among college students. *Journal of College Student Development, 38*(6), 633-644.

Schaufeli, W., & Enzmann, D. (1998). *The burnout companion to study and practice: A critical analysis*. New York, NY: CRC Press.

Shulock, Nancy B. 2009. Case studies of state P–16 and P–20 councils. In states, schools, and colleges: Policies to improve student readiness for college and strengthen coordination between schools and colleges, 55–139. San Jose, CA: National Center for Public Policy and Higher Education.

Schwartz, M. S. (2010). A new improved universally accepted official definition of biofeedback: where did it come from? Why? Who did it? Who is it for? What's next? *Biofeedback*, *38*(3), 88–90.

Schwartz, M. S., & Andrasik, F. (2017). *Biofeedback: A practitioner's guide*. New York, NY: Guilford Publications.

Seidman, S. A., & Zager, J. (1991). A study of coping behaviours and teacher burnout. *Work and Stress*, *5*(3), 205–216.

Shadish, W. R., Cook, T. D., & Campbell, D. T. (2002). *Experimental and quasi-experimental designs for general causal inferences*. Belmont, CA: Wadsworth Cengage Learning.

Shapiro, S. L., Shapiro, D. E., & Schwartz, G. E. (2000). Stress management in medical education: a review of the literature. *Academic Medicine*, *75*(7), 748-759.

Shepherd, K. G., Fowler, S., McCormick, J., Wilson, C. L., & Morgan, D. (2016). The search for role clarity: Challenges and implications for special education teacher preparation. *Teacher Education and Special Education*, *39*(2), 83–97.

Shernoff, E. S., Mehta, T. G., Atkins, M. S., Torf, R., & Spencer, J. (2011). A qualitative study of the sources and impact of stress among urban teachers. *School Mental Health*, *3*(2), 59-69.

Sherwood, L. (2006). *Fundamentals of physiology: A human perspective.* Pacific Grove, CA: Thomson Brooks.

Singh, N. N., Lancioni, G. E., Winton, A. S. W., Karazsia, B. T., & Singh, J. (2013). Mindfulness training for teachers changes the behavior of their preschool students. *Research in Human Development, 10*(3), 211–233. https://doi.org/10.1080/15427609.2013.818484

Singh, N. N., Lancioni, G. E., Winton, A. S. W., Singh, J., Curtis, W. J., Wahler, R. G., & McAleavey, K. M. (2007). Mindful parenting decreases aggression and increases social behavior in children with developmental disabilities. *Behavior Modification, 31*(6), 749–771.

Singh, N. N., Singh, A. N., Lancioni, G. E., Singh, J., Winton, A. S. W., & Adkins, A. D. (2010). Mindfulness training for parents and their children with ADHD increases the children's compliance. *Journal of Child and Family Studies, 19*(2), 157–166.

Siwatu, K. O., Frazier, P., Osaghae, O. J., & Starker, T. V. (2011). From maybe I can to yes I can: Developing preservice and inservice teachers' self-efficacy to teach African American students. *The Journal of Negro Education, 80*(3), 209–222.

Skaalvik, E. M., & Skaalvik, S. (2007). Dimensions of teacher self-efficacy and relations with strain factors, perceived collective teacher efficacy, and teacher burnout. *Journal of educational psychology*, *99*(3), 611-625.

Skaalvik, E. M., & Skaalvik, S. (2015). Job satisfaction, stress and coping strategies in the teaching profession—What do teachers say?. *International Education Studies*, *8*(3), 181.

Skaalvik, E. M., & Skaalvik, S. (2016). Teacher stress and teacher self-efficacy as predictors of engagement, emotional exhaustion, and motivation to leave the teaching profession. *Creative Education, 7*(1), 1785–1799.

Skiba, R. J., Simmons, A. B., Ritter, S., Gibb, A. C., Rausch, M. K., Cuadrado, J., & Chung, C. G. (2008). Achieving equity in special education: History, status, and current challenges. *Exceptional Children, 74*(3), 264-288.

Smith, T., & Ingersoll, R. (2004). What are the effects of induction and mentoring on beginning teacher turnover? *American Educational Research Journal, 41*(1), 681–714.

Smylie, M. A. (1999). Teacher stress in a time of reform. In R. Vandenberghe, A. M. Huberman, R. Vandenberghe, & A. M. Huberman, *Understanding and preventing teacher burnout: A sourcebook of international research and practice.* (pp. 59–84). New York, NY: Cambridge University Press. https://doi.org/10.1017/CBO9780511527784.005

Sparks, D. (1983). Practical solutions for teacher stress. *Theory into Practice, 22*(1), 33-42.

Stauffer, S. D., & Mason, E. C. M. (2013). Addressing elementary school teachers' professional stressors: Practical suggestions for schools and administrators. *Educational Administration Quarterly*, *49*(5), 809–837.

Stein, F. (2001). Occupational stress, relaxation therapies, exercise and biofeedback. *Work, 17*(3), 235–245.

Stein, F., & Cutler, S. K. (1998). Psychosocial occupational therapy. San Diego, CA: Singular Publishing Group.

Superfine, B. M. (2011). Stimulating school reform: The American recovery and reinvestment act and the shifting federal role in education. *Missouri Law Review, 76*(1), 81-1291.

Sutcher, L., Darling-Hammond, L., & Carver-Thomas, D. (2016). *A coming crisis in teaching? Teacher Supply, Demand, and Shortages in the US*. Washington, DC: Learning Policy Institute

Swartz, R. A., & McElwain, N. L. (2012). Preservice teachers' emotion-related regulation and cognition: Associations with teachers' responses to children's emotions in early childhood classrooms. *Early Education and Development, 22* (1), 202–226.

Sydnor, J. (2017). "I didn't realize how hard it would be!": Tensions and transformations in becoming a teacher. *Action in Teacher Education, 10*(4), 1–19.

Tatum, B. D. (1994). Teaching White students about racism: The search for White allies and the restoration of hope. *Teachers College Record*, *95*(4), 462-476.

Taylor, A., & Frankenberg, E. (2009). Exploring urban commitment of graduates from an urban-focused teacher education program. *Equity & Excellence in Education, 42*(3), 327–346.

Thomas, J. Y., & Brady, K. P. (2005). Chapter 3: The Elementary and Secondary Education Act at 40: Equity, accountability, and the evolving federal role in public education. *Review of Research in Education*, *29*(1), 51-67.

Todd, T. (2011). Improving optimal performance—and life—for young athletes. *Biofeedback*, *39*(3), 109-111.

Tucker-Drob, E. M., & Harden, K. P. (2012). Intellectual interest mediates gene× socioeconomic status interaction on adolescent academic achievement. *Child Development*, *83*(2), 743-757.

Van de Water, G., & Rainwater, T. (2001). *What is P-16 education? A primer for legislators.* A Practical Introduction to the Concept, Language and Policy Issues of an Integrated System of Public Education.

Van Diest, I., Bradley, M. M., Guerra, P., Van den Bergh, O., & Lang, P. J. (2009). Fear-conditioned respiration and its association to cardiac reactivity. *Biological Psychology*, *80*(2), 212–217.

Vlemincx, E., Taelman, J., De Peuter, S., Van Diest, I., & Van Den Bergh, O. (2011). Sigh rate and respiratory variability during mental load and sustained attention. *Psychophysiology, 48*(1), 117–120.

Warren, D. (1985). Learning from experience: History and teacher education. *Educational Researcher, 14*(10), 5–12.

Walpole, M. (2003). Socioeconomic status and college: How SES affects college experiences and outcomes. *The Review of Higher Education, 27*(1), 45-73.

Wilson, S. M., Darling-Hammond, L., & Berry, B. (2001). *A case of successful teaching policy: Connecticut's long-term efforts to improve teaching and learning.* Seattle, WA: Center for the Study of Teaching and Policy, University of Washington.

Wilson, V. E., Peper, E., & Moss, D. (2006). "The mind room" in Italian soccer training: The use of biofeedback and neurofeedback for optimum performance. *Biofeedback, 34*(3), 79-81.

Wispé, L. (1991). *The psychology of sympathy*. Springer Science & Business Media.

Witt, J. C., & Elliott, S. N. (1985). Acceptability of classroom intervention strategies. In T.R. Kratochwill (Ed.), *Advances in School Psychology*. (pp. 251–288). Hillsdale, NJ: Lawrence Erlbaum Associates.

Witt, J. C., Noell, G. H., LaFleur, L. H., & Mortenson, B. P. (1997). Teacher use of interventions in general education settings: Measurement and analysis of the independent variable. *Journal of Applied Behavior Analysis, 30*(4), 693–696.

Wolf, M. M. (1978). Social validity: The case for subjective measurement or how applied behavior analysis is finding its heart. *Journal of Applied Behavior Analysis, 11*(2), 203–214.

Worthy, J. (2005). “It didn”t have to be so hard’: The first years of teaching in an urban school. *International Journal of Qualitative Studies in Education*, *18*(3), 379–398.

Yell, M., Rogers, D., & Rodgers, E. L. (1998). The legal history of special education. *Remedial & Special Education*, *19*(4), 219–229.

Yoon, J. S. (2002). Teacher characteristics as predictors of teacher-student relationships: Stress, negative affect, and self-efficacy. *Social Behavior and Personality, 30*(5), 485-493.

Zeichner, K. (1992). Rethinking the practicum in the professional development school partnership. *Journal of Teacher Education*, *43*(4), 296–307.

Zeichner, K. (2003). The adequacies and inadequacies of three current strategies to recruit, prepare, and retain the best teachers for all students. *Teachers College Record*, *105*(3), 490-519.

Zeichner, K. (2005). Becoming a teacher educator: A personal perspective. *Teaching and Teacher Education*, *21*(2), 117–124.

Zeichner, K. (2014). The struggle for the soul of teaching and teacher education in the USA. *Journal of Education for Teaching*, *40*(5), 551–568.