In search of hidden talents: stress-adapted students, classroom characteristics, and academic achievement

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IN SEARCH OF HIDDEN TALENTS: STRESS-ADAPTED STUDENTS, CLASSROOM CHARACTERISTICS AND ACADEMIC ACHIEVEMENT

by

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A Dissertation
Submitted to the University at Albany, State University of New York
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ABSTRACT

Differentiated Instruction, an approach to teaching that encourages educators to adjust their content, pedagogy, and assessment based on the needs of individual students, lacks suggestions for how to target specific student groups, such as “high-risk” students. Researchers in the field of evolutionary developmental psychology have begun to focus on stress-adapted students (who are described in a similar way as “high risk” students) and has made suggestions about how to play to the strengths of the cognitive enhancements, or “hidden talents” of these students. When considered together, the work from both fields may provide a clear set of pedagogical recommendations for teachers who wish to adjust their practice to meet the needs of students who have experiences social and economic disadvantage. This study tested the relationships between pedagogical practices (using ecologically relevant content, task-shifting, and immediate rewards), classroom environments (allowing for noise and movement during learning activities), stress-adapted students (students who qualify for free or reduced-priced lunch, live in single parent homes, speak a language other than English at home, and have no working method of contact between parents and teachers), and class average grade. Results showed a significant relationship between the number of stress-adapted students in a class and the class average grade, such that higher numbers of stress-adapted students were associated with lower class average grades. This study demonstrates that the well-known relationship between social and economic disadvantage and academic achievement persists regardless of the mode of instruction (face-to-face or online). Future research should test these relationships in the context of face-to-face learning in traditional school settings to investigate how pedagogical techniques and classroom environments impact the connection between stress-adapted students and class average grade in context not influenced by COVID-19 educational changes.
DEDICATION

To my former and future students. May our relationships always be mutually beneficial.
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I appreciate that my dissertation committee: Dr. Schlomer, Dr. Colvin, and Dr. Ellis-Robinson have all not only been incredibly helpful during this last phase of the Ph.D. process, but throughout my entire graduate experience. I could write for pages providing details to support this claim, but I don’t think that would be appropriate here. I hope these next few paragraphs will be sufficient.

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the worlds of academia and practice can coexist meaningfully. Thank you, Dr. Ellis-Robinson, for showing and telling me how to be a better teacher.

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CHAPTER ONE
INTRODUCTION

Problem Motivating the Proposed Study

Teachers and researchers alike have known for decades that in order to best educate students, a variety of pedagogical techniques or teaching strategies should be used to meet the needs of students who are at various stages of physical, cognitive, and socioemotional development. In the early 2000’s, educational research on differentiated instruction, a method used by teachers to adapt their pedagogical approach to account for variance in student abilities, became the focus of professional development for educators (Tomlinson, 2000). When teachers use differentiated instruction, they vary the content, activities, and environment in the classroom. Adjustments are made to increase the learning of students who are at various levels of cognitive, physical, and socio-emotional development. Adjustments occur not only across a unit plan, but even within one class. Differential instruction promotes an awareness of the needs of students at both ends of the skill continuum, instead of “teaching to the middle” (Subban, 2006). As each classroom features a unique set of students and needs, there is no set “package,” rather, differentiated instruction is an approach that incorporates a variety of techniques tailored to individual students and classrooms (Hall, 2002).

Despite the fact that teachers and researchers seem to agree that differentiated instruction is a logical approach to teaching in classrooms that feature increasingly diverse students, research demonstrating why it works, or that it does work, is limited (Tomlinson, 2000; Hall, 2002, Santangelo, & Tomlinson, 2009). Hall (2002) noted that differentiated instruction lacks empirical support, but there are some studies that show support for the effectiveness of differentiated instruction in classrooms (Valiandes, 2015; Reis, McCoach, Little, Muller, &
Kaniskan, 2011). The fact that differentiated instruction is not one set of teaching techniques, but rather a “package” or approach makes it a challenge to test empirically. As a result, there is a plethora of information available about how to implement differentiated instruction (Tomlinson, 2000; Subban, 2006, Benjamin, 2002; Tomlinson & McTighe, 2006), but evidence supporting its effectiveness or specific guidelines are sometimes based on anecdotes and case studies with weak methodologies (Ernest, Thompson, Heckaman, Hull, & Yates, 2011).

An interesting facet of the problem regarding the lack of empirical research on differentiated instruction is that there is research being done in this area. One possible reason that teachers, and perhaps the field of educational research broadly, do not know that such resources exist, is because it is being published in a field with low exposure—the field of evolutionary developmental psychology. Life history theory (LHT) is a well-known theory used by many evolutionary developmental psychologists as a framework for understanding how humans allocate time and energy to various biological and developmental needs (Del Giudice, Gangstead, & Kaplan, 2015). LHT has been used to explain a wide range of human behaviors, such as risk taking in adolescents, mate selection, and religiosity (Figueroedo, & Jacobs, 2010; Figueredo et al., 2006; Figueredo, de Baca, & Woodley, 2013). A handful of evolutionary developmental psychologists have begun to focus on connecting life history theory to pedagogy and educational outcomes (Ellis, Bianchi, Griskevicius, & Frankenhuis, 2017; Frankenhuis, & de Weerth, 2013; Frankenhuis, de Vries, Bianchi, & Ellis, 2019; Mittal, Griskevicius, Simpson, Sung, & Young, 2015). Their work attempts to make connections between how early childhood environments can shape cognitive development in predictable ways, which subsequently impacts academic achievement in predictable ways, and therefore provide evidence as to why differentiated instruction works.
Just as those in the field of educational research may not be aware that life history theory is the missing piece of the differentiated instruction puzzle, the field of evolutionary developmental psychology may not realize that they are holding the missing piece in their hand. As of April, 2020, there are no published articles between the years of 1970 and 2020 featuring the phrases “life history theory” and “differentiated instruction” in their titles or abstracts available on Google Scholar or ProQuest. Dr. Bruce Ellis, one of the pioneering researchers of life history theory and its implications for education, described the philosophical underpinnings of differentiated instruction in his research without referring to the approach directly (Ellis, Bianchi, Griskevicius, & Frankenhuis, 2017).

Evolutionary developmental psychology not only offers a perspective that explains why differentiated instruction works, but also specific guidelines regarding teaching approaches that work best with a subgroup of students often referred to as “high-risk” or “at-risk” in the educational psychology literature (Angelis, Wilcox, & Baker, 2014; Battin-Pearson et. al., 2000; Boyer, 1983). These terms are used to describe students who are at risk of not graduating high school and often face social and economic disadvantage. Recent work in the field of evolutionary developmental psychology has focused on reframing the conversation about at-risk students by referring to them as “stress-adapted” students (Ellis, Bianchi, Griskevicius, & Frankenhuis, 2017). The term “stress-adapted” is used to describe individuals who have experienced a harsh and unpredictable early life environment, or, environments characterized by economic, social, and material hardships associated with poverty (e.g., poor housing conditions, family instability, familial mental and physical health problems, financial instability and hardship) (Ellis, Bianchi, Griskevicius, & Frankenhuis, 2017). Whereas the term “at-risk” defines a population by a
potential negative outcome, “stress-adapted” shifts the focus to what an individual has experienced, rather than what they might become.

Research with stress-adapted individuals has shown not only that these students may have “hidden talents,” but that the demonstration of those talents may be context dependent (Frankenhuis, & de Weerth, 2013). This work, and other similar research (e.g. Frankenhuis, Vries, Bianchi, & Ellis, 2019; Mittal, Griskevicius, Simpson, Sung, & Young, 2015), provides ideas for how teachers might choose teaching strategies and create learning environments that play to the strengths of their at-risk or stress-adapted students. In this way, evolutionary developmental psychology can offer clarity about how to fine-tune the use of differentiated instruction with stress-adapted students.

**Purpose of Proposed Study**

The purpose of this study is to use the combined knowledge of evolutionary developmental psychology and educational psychology to investigate the relationship between pedagogical techniques and classroom environments that play to the strengths of stress-adapted students and academic achievement. I believe that teachers who use differentiated teaching strategies based on what has been demonstrated in the field of evolutionary development psychology will create an ideal context for stress-adapted students to showcase their “hidden talents.” I hypothesize that classrooms with higher numbers of stress-adapted students will show higher class averages when the teacher uses ecologically relevant materials, immediate rewards, and task-shifting activities in classrooms that promote conversation and movement.

**Implications of Proposed Study**

Finding from this study would provide a clear path for teachers to follow when implementing differentiated instruction with stress-adapted students. Many teachers report that
although they see the value in differentiated instruction, they feel overwhelmed and lack
guidance about how to implement it in their classrooms (Bondie, Dahnke, & Zusho, 2019).
When facing students who typically struggle, teachers would be armed with knowledge about
what kinds of skills stress-adapted students have, which can guide their decisions regarding
teaching techniques. Additionally, teachers will also know how to create a learning environment
that best highlights the strengths of stress-adapted students. If used in combination, these two
important components of instruction could make classrooms a more successful place for students
who often face academic challenges.

Furthermore, this study would serve to bridge the gap between evolutionary
developmental psychology and educational psychology by showing that theories from both fields
used in tandem result in a more cohesive understanding of students at risk for academic failures.
Educational psychology has provided teachers with information about what to do—implement
differentiated instruction. The field of evolutionary psychology’s life history theory can offer
information about why differentiated instruction works and how to implement the approach for
best results with stress-adapted students. No previous research has explicitly approached
academic achievement with differentiated instruction and life history theory guiding the
investigation, and the results from this combined approach will provide the empirical evidence
that differentiated instruction has lacked.

To this end, I plan to test the following hypotheses:

H1: Stress-Adapted Student Score, Pedagogical Techniques Score, and Classroom Environment
Score are all linearly related to Class Average.

H1A: Stress-Adapted Student Score will be negatively related to Class Average

H1B: Pedagogical Techniques Score will be positively related to Class Average
H1C: Classroom Environment Score will be positively related to Class Average.

H2: Stress-Adapted Student Score, Pedagogical Techniques Score, and Classroom Environment Score, together, can be used to predict Class Average.

H3: The interaction between Stress-Adapted Student Score and Pedagogical Techniques score will moderate the relationship between Stress-Adapted Student Score and Class Average.

H4: The interaction between Stress-Adapted Student Score and Classroom Environment Score will moderate the relationship between Stress-Adapted Student Score and Class Average.
CHAPTER TWO

In this chapter, I will review the relevant bodies of literature that pertain to the current study. These areas relate to theory that guides the investigation, the population in question, pedagogical techniques, and the learning context. Relevant theory includes life history theory, the adaptation approach, and the sensitization and specialization hypotheses. The population of interest is stress-adapted students. Pedagogical techniques that are of interest include ecologically relevant content, task-shifting, and immediate rewards. The learning context, or classroom environment, is also reviewed.

LITERATURE REVIEW

Life History Theory. Life history theory is an evolutionary perspective regarding the strategies that species use to allocate resources for survival and reproduction (Ellis, Figueredo, Brumbach, & Schlomer, 2009). The allocation of resources to these life functions occurs via trade-offs between the competing biological needs of growth, reproduction, and maintenance. Strategies vary based on environmental conditions (commonly understood in terms of harshness and unpredictability; see Ellis, Figueredo, Brumbach, & Schlomer, 2009) and individual characteristics. Life history strategies are referred to as “fast” or “slow” and are characterized by patterns of trade-offs that shape developmental trajectories (Del Giudice, Gangstad, & Kaplan, 2015). Fast and slow strategies are understood as representing two ends of a continuum, where fast is associated with earlier maturation and reproduction, lower levels of parental investment and shorter lifespans and slow is associated with later maturation and reproduction, higher levels of paternal investment, and longer life spans. Fast life history strategies often occur in harsh and unpredictable environments, whereas slow life history strategies are associated with safe and predictable environments. Life history strategies can be understood in two ways: between and
within species. The between-species application is guided by evolutionary concepts and compares species to one another in order to predict their life history strategy. For example, species like rabbits and fish, tend to have a “quantity over quality” trade-off approach to offspring, which is manifested by beginning reproduction earlier in life and engaging in higher levels of reproduction and lower levels of parental investment. In the harsh and unpredictable environments that both rabbits and fish typically live, these clusters of behaviors regarding resource allocation increase survival and reproduction. “Slow” species, like elephants and humans, demonstrate a “quality over quantity” approach, which features a later start to reproduction, fewer offspring and higher levels of parental investment (Ellis, Figueredo, Brumbach, & Schlomer, 2009). Elephants and humans generally live in safe, predictable environments; therefore, they use a different trade-off strategy, shifting their energy to somatic development and parenting, with the expectation that the future continues to be as the present is.

Alternatively, to the between-species application described above, life history strategy can also be applied in a within-species developmental version (Ellis, Figueredo, Brumbach, & Schlomer, 2009). This approach can be used to evaluate how variation in local ecologies shape developmental trajectories in humans and result in fast and slow strategies within our species. Similarly, to the fish and rabbits who live in harsh and unpredictable environments, humans from these kinds of environments may also adapt to an uncertain future by experiencing early reproductive development, earlier sexual debut, and reduced effort in parenting (Belsky, Steinberg, & Draper, 1991). Humans from safe and predictable environments, however, may adapt by delaying reproductive development and sexual debut and increasing parenting effort. In addition to offering insight about reproductive behavior in humans, life history theory can also be used to inform studies of personality, individual differences, and psychopathology (Ellis,
For example, individuals at the “fast” end of the continuum tend to demonstrate higher levels of risk-taking behavior. This behavior is adaptive for individuals who live in harsh and unpredictable environments because their future is uncertain and risk taking may lead to acquiring resources immediately that are necessary for survival. (Richardson, Castellano, Stone, & Sanning, 2016).

When applied to educational contexts, life history theory research proposes that individuals on the fast and slow ends of the spectrum should show variability in their cognitive development (Todd, Hertwig, & Hoffrage, 2015; Del Giudice, Gangstead, & Kaplan, 2015). In harsh and unpredictable environments, attention shifting and immediate behavioral responses would serve to protect an individual from threats accompanying their environment (Griskevicius, Tybur, Delton, & Robertson, 2011). These behaviors, which are adaptive and protective in unsafe environments, may become maladaptive in educational settings. Traditional schools require large amounts of sustained attention and inhibitory control—two cognitive skills that are not adaptive in harsh and unpredictable environments. Students demonstrating a fast life history strategy may find it difficult to be successful in school, as they are adaptively calibrated to shift their focus frequently.

**Adaptation-based Approach to Resilience.** Traditional models that investigate the relationship between students who have been exposed to stress (or, come from harsh and unpredictable environments), cognitive development, and educational outcomes focus primarily on negative outcomes and cognitive deficits. Myriad studies show that stress exposure is associated with impaired executive functioning, memory, language, reading and math skills, and lower IQ (Blair et al., 2011; Farah et al., 2006, Hackman, Gallop, Evans, & Farah, 2015). Whereas there is a robust amount of empirical evidence supporting the deficit perspective, it is
not the only way to investigate the relationship between stress exposure and educational outcomes. The adaptation-based approach rejects the notion that exposure to stress universally impairs cognition and instead focuses on the kinds of cognitive advantages (often referred to as “hidden talents”) that individuals may develop as a result of exposure to harsh and unpredictable environments (Frankenhuis, & Nettle, 2019; Ellis, Bianchi, Griskevicius, & Frankenhuis, 2017, Frankenhuis, Panchanathan, & Nettle, 2016; Frankenhuis & de Weerth, 2013). Researchers in this area do not suggest that we ignore the real impact that poverty has on cognitive development (which is the focus of the tradition Deficit model), but that we broaden our understanding of the impact of poverty by also investigating the ways in which adversity might enhance cognition (Frankenhuis, Young, & Ellis, 2020). These cognitive enhancements can be best understood in terms of their functions as specializing and sensitizing individuals so that they are optimally adapted to their environments.

The specialization hypothesis asserts that individuals will adapt to their developmental environment, such that they are better able to solve problems relevant to their immediate ecological surroundings. In harsh and unpredictable environments, this might mean that a person could be better at shifting their attention quickly to accommodate rapid changes in their environment or identifying angry faces, both of which could be protective in dangerous situations. For example, the cognitive process of task-shifting has been shown to be enhanced in adults who grew up in harsh and unpredictable environments (Mittal, Griskevicius, Simpson, Sung, & Young, 2015). Furthermore, Pollak, Messner, Kistler, and Cohn (2009) found that abused children recognized anger faster and more accurately than children who were not abused and suggested that the children’s emotional perception may be heightened as a result of their experiences with abuse. Additionally, Frankenhuis, de Vries, Bianchi, and Ellis (2019) found
that adults who currently reside in dangerous neighborhoods showed better memory for dominance relationships than adults living in safe neighborhoods. This suggests that individuals exposed to violence may develop cognitive strengths that will improve their likelihood of survival, such as quickly evaluating their position of social dominance relative to others and shifting attention rapidly. Taken together, these findings show that exposure to harsh and unpredictable environments does not universally impair cognition but instead shapes cognition.

The compliment of the specialization hypothesis is the sensitization hypothesis, which outlines how individuals not only develop skill sets that enable them to adapt to their environments, but also that individuals perform best when they are demonstrating their adaptations within the correct evolutionary-developmental context (Frankenhuis, & de Weerth, 2013). For example, Mittal et al (2015) showed that adults who grew up in unpredictable environments performed best on task-shifting assessments when they were tested in uncertain contexts. The authors conclude that cognitive adaptations stemming from early life exposure to unpredictable conditions were highlighted only when current conditions matched early childhood ecologies. Young, Griskevicius, Simpson, Waters, and Mittal (2018) found similar results in their two experiments investigating the relationship between exposure to unpredictable environments and working memory. Young and colleagues found that adults from unpredictable environments performed better on working memory tasks within the context of a currently uncertain financial environment (a feeling induced by watching a slide show about increasingly worsening economic conditions) than adults from predictable environments. These two studies demonstrate not only that exposure to early life stress can result in enhanced cognition, especially when the current context matches the developmental context, and therefore provide empirical evidence for the specialization and sensitization hypothesis.
The sensitization and specialization hypotheses outline what kinds of cognitive advantages stress-adapted students might have and why they might have them. Additionally, these hypotheses provide insight into what kinds of environments might best showcase the hidden talents of stress-adapted students. Although teachers are most likely unaware of these hypotheses, many of the things they do in the classroom play to the strengths of stress-adapted students and are fundamental to differentiated instruction. For example, using ecologically relevant materials (evolutionary psychology), or, connecting content to students’ interests and cultures (educational psychology), is essential from both research perspectives (Tomlinson, 2002, Frankenhuis & de Weerth, 2013). Additionally, Ellis, Bianchi, Griskevicius, and Frankenhuis, (2017) hypothesize that stress-adapted students will respond well to task-shifting, or, moving through several activities that each do not required sustained attention, and to immediate feedback and rewards. Furthermore, in line with the sensitization hypothesis, the authors suggest that when students’ learning environment matches the environment they have adapted to, their talents will not only match, but potentially exceed those of their non-stress-adapted peers. To date, there are no empirical tests of the sensitization and specialization hypotheses impact student learning. However, Ellis and colleagues (2017) hypothesize that classrooms in which movement and background noise (similar to what might be found living in close proximity to neighbors and family in low-income neighborhoods) would offer a better evolutionary-developmental context for stress-adapted students.

**Stress-Adapted Students.** The phrase “stress-adapted” refers to individuals who grow up in high adversity situations (Ellis, Bianchi, Griskevicius, & Frankenhuis, 2017). High adversity is often referred to as socially and economically disadvantaged (Frankenhuis, de Vries, Bianchi, & Ellis, 2019) or a harsh and unpredictable environment (Ellis, Figueredo, Brumbach,
The terms high adversity, social and economic disadvantage and harsh and unpredictable are all ways of describing stressful environments and are operationalized similarly. Suor, Sturge-Apple, Davies, and Cicchetti (2017) defined harshness as low maternal investment and economic resources (earned annual household income), and related research used the Family Instability Questionnaire, which asked questions about changes of caregivers, residences, job income, and family members to measure unpredictability (Sturge-Apple, Davies, Cicchetti, Hentges, & Coe, 2017).

In educational research, these students are called “at-risk,” “high-risk,” or “vulnerable” (Angelis, Wilcox, & Baker, 2014; Battin-Pearson et. al., 2000; Boyer, 1983). The “risk” embedded in the terms refers to risk of educational failures or non-completion. Research on high-risk students often uses similar components in defining this group, identifying them as students whose families speak a language other than English as their primary language, live in poverty and qualify for free or reduced lunch (Angelis, Wilcox, & Baker, 2014).

Describing students as stress-adapted redirects the focus to the cognitive and behavioral adaptations associated with developing in socially and economically disadvantaged environments (Frankenhuis, de Vries, Bianchi, & Ellis, 2019). These adaptations are often overlooked from the perspective of the deficit model, which highlights the disadvantages in social and cognitive development, but fails to recognize the potential strengths developed in these areas as well (Ellis, Bianchi, Griskevicius, & Frankenhuis, 2017; Farah et al., 2006, Hackman, Gallop, Evans, & Farah, 2015).

**Differentiated instruction.** Differentiated instruction is an approach to teaching that attempts to address variance between students in their proficiency, interests, and learning preferences (Tomlinson & McTighe, 2006). When using this approach, teachers are encouraged
to adapt four classroom elements: content (what a student needs to learn), process (the activities that facilitate learning), products (the ways in which learning is demonstrated), and learning environment (the way the classroom works and feels) (Tomlinson, 2000). Several aspects of the differentiated approach are consistent with research emerging in the field of evolutionary developmental psychology. Carol Ann Tomlinson, an expert in the field of differentiated instruction, consistently highlights the importance of putting student interest at the forefront when making instructional and curriculum decisions. In a recent literature review of 28 studies of differentiated instruction, Bondie, Dahnke, & Zusho (2019) found that many studies of the implementation of differentiated instruction involved adapting content to students’ cultural contexts, demonstrating that this element of differentiated instruction is commonly used by teachers. In the section on ecologically relevant content below, research from the field of evolutionary developmental psychology that also suggest that students learn best when the content plays to their interests, is discussed. Task-shifting and incorporating immediate rewards (described below) are two ways that a teacher could adapt the process of learning in order to best account for the strengths of stress-adapted students. Finally, adjusting the learning environment to have both quiet and collaborative areas and acknowledging that some students learn better with movement (Tomlinson, 2000) parallels what research from the field of evolutionary developmental psychology has found with stress-adapted students. In each of the sections that follows, research demonstrating what works with stress-adapted students and why it works is examined.

**Ecologically relevant content.** Research in both the evolutionary developmental psychology and educational fields concur that it is imperative to frame classroom material to connect with students. Tomlinson and McTighe (2006), in their guidelines to implementing
differentiated instruction, encourage teachers to connect content to students’ backgrounds and interests in order to increase motivation and to make learning relevant to their lives. Frankenhuis and de Weerth (2013), in their review of research on how early life stress shapes cognition, suggest that individuals who experienced stress in their early childhood should demonstrate improved detection, learning, and memory on tasks that are ecologically relevant to them, when compared to peers that experienced lower levels of developmental stress. Richardson, Castellano, Stone, and Sanning, (2016) concur with Frankenhuis and de Weerth, (2013), and further argue that career and technical education programs offer an ideal model for stress-adapted students because they frame the content in ways that appeal to adolescent’s current biopsychosocial context, which includes improved resource control, peer status, and access to mates. When students learn from adults who have experience working in the areas of their instruction, their learning is connected to immediate application, which in turn, is associated with immediate resource control. This is especially important for at risk students who come from harsh and unpredictable environments because the associated fast life history strategy of these students biases them to value information that will aid in achieving short-term goals (like gaining social status). Geary (2011) offers further support to this idea, suggesting that children are not inherently motivated to learn what is taught in school because the content is meant to prepare them for the modern world, whereas brain development from an evolutionary perspective would bias children towards being motivated to learn about things related to social, biological, and physical resources necessary for survival and reproduction (evolved information processing biases). Most of what is taught in school is biologically secondary material, or, information that humans have not evolved to acquire, such as cultural information (Paas & Sweller, 2012). When
biologically secondary material is related to the social/biological/physical information needed for survival, the material becomes more salient.

Empirical evidence to support the importance of framing content in ecologically relevant ways come from the fields of evolutionary developmental psychology and education. Walkington (2013) described ecologically relevant content in terms of context personalization, a type of interest-based intervention where instructional contexts are matched to students’ out-of-school interests. In Walkington’s study, students used technology-based content personalization to match math stories with their out-of-school interests, like sports, music, and movies. Students who completed math problems that matched their interest showed significant improvement in secondary mathematics skills compared to when they learned new math content without context personalization. Schliemann and Carraher (2002) found similar results with Brazilian third graders who had experience in Brazilian street markets, demonstrating that they were better able to solve algorithmic math problems when the problems had to do with buying and selling goods when compared to conceptual algorithmic math problems. This shows that when the problem was ecologically relevant, the children could better demonstrate the skills tested in schools. The evidence provided in these studies, combined with the theoretical perspectives outlined above, shows that students generally, and stress-adapted students in particular, should benefit academically when content is ecologically relevant because information that is salient is of priority when functioning in a harsh and unpredictable environment.

**Task shifting.** Harsh and unpredictable environments, and the individuals exhibiting a fast life history strategy as a result of that developmental context, may have adapted a diffuse attentional style because it is hypothesized to be protective in an environment with imminent threats and scarce resources (Frankenhuis, Panchanathan, & Nettle, 2016). Task shifting, when
understood as the opposite of sustained attention, is often described as an executive dysfunction (Razza, Martin, & Brooks-Gunn, 2010; Andrade, Brodeur, Waschbusch, Stewart, & McGee, 2009). However, it is also appropriately described as a conditional adaptation, because it is likely useful and protective in harsh and unpredictable environments (Frankenhuis, & Nettle, 2019; Richardson, Castellano, Stone, & Sanning, 2016). Mittal, Griskevicius, Simpson, Sung, and Young (2015) found that adults who had experienced unpredictable childhoods performed better on measures of task shifting than adults who had experienced predictable childhood environments. Vandenboucke et al., (2016) found similar results, showing that children from low-income families with low-educated mothers scored better on response shifting (a component of cognitive flexibility that develops before task shifting) than children from high-income families with highly-educated mothers. Na and Chan (2016) also showed that high-risk children had better response inhibition (an aspect of inhibitory control related to task shifting) than their low-risk peers. It is clear that empirical evidence supports the notion that stress-adapted individuals are often better than their peers at task shifting, which suggests that teachers may be able to capitalize on this strength in their students.

**Immediate rewards.** Adolescents in general, and stress-adapted adolescents in particular, are drawn to immediately gratifying experiences, which can make it difficult for them to appreciate learning that leads to long-term benefits that occur in unfamiliar contexts (Richardson, Castellano, Stone, & Sanning, 2016). Harsh and unpredictable environments may bias individuals to devalue the future in favor of short-term opportunities and rewards (Ellis, Figueredo, Brumbach, & Schlomer, 2009). Preference for immediate rewards is hypothesized to be an adaptive response to uncertain and rapidly changing environments (Mittal, Griskevicius, Simpson, Sung, & Young, 2015). Consistent with this hypothesis, Suor, Sturge-Apple, Davies,
and Cicchetti, (2017) found that environmental harshness at age 2 was predictive of better reward-oriented problem solving at age 4, when compared to visual problem solving. Additionally, Humphreys et al., (2015) showed that children who were previously institutionalized (and thereby exposed to stressful environments) chose exploitive over exploratory strategies, when compared to youth who had not been institutionalized. Exploitive decision-making strategies rely on information from previous experiences to choose a potentially limited but promising outcome, whereas exploratory strategies encourage choosing options with unknown, but potentially more rewarding, outcomes (Cohen, McClure, & Yu, 2007). Exploitive strategies have a higher guarantee of an immediate reward compared to exploratory strategies. Consistent with Humphreys et al., (2015), Sturge-Apple, Davies, Cicchetti, Hentges, and Coe (2017), found that children from unstable environments favored immediate rewards over future payoffs more than their peers from stable environments. In research with college students, Griskevicius, Tybur, Delton, and Robertson (2011) found that students from low SES backgrounds favored higher risk, immediate rewards over low risk, long term higher rewards, especially when primed by unfavorable mortality and resource cues. Taken together, previous research demonstrates that stress-adapted individuals will be more likely to be motivated by immediate rewards, and thus, their use in the classroom could result in improved learning outcomes for stress-adapted students.

**Learning Environment.** In accordance with the sensitization hypothesis (Ellis et al., 2017), individuals will be able to best demonstrate their cognitive adaptations when the environment they are functioning in matches the environment they developed in. For example, Mittal et al., (2015) showed that college students from unpredictable childhood environments
performed better on task-shifting measures when they were tested in an experimentally-induced unpredictable context.

Studies theoretically aligned with an adaptation-based approach to development in educational contexts should be based in a context that mirrors students’ ecologies. In the case of stress-adapted students, this will mean conversation rather than pencil and paper, because this more closely resembles how children typically confront problems in real-life (Frankenhuis, & de Weerth, 2013). Additionally, environments that allow for movement and talking may simulate the context in which stress-adapted students developed their skills, and will therefore play to their hidden talents better than quiet, controlled environments (Ellis et al., 2017). There is very little empirical evidence of the sensitization hypothesis with school-aged children. One study conducted by Schliemann and Carraher (2002) found that low-income Brazilian third graders showed higher performance in mathematical algorithms when allowed to solve problems in their minds (which they did frequently outside of school) when compared to using pencil and paper. This demonstrates that when given the opportunity to demonstrate their skills in a way that matched the context in which they learned the skill, the students performed better.

Goudeau and Croizet (2017) investigated the relationship between classroom environments and students’ social class. They hypothesized that the classroom environment undermined the achievement of working-class students because it was designed to play to the strengths of the middle-class students’ cultures and experiences. They found that when working class students (whose home environments do not match the classroom environment) were unaware of academic standards (such as the importance of hand-raising and the meaning of academic vocabulary) the differences in their performance on a reading task was significantly lower compared to their middle-class peers. However, when the same students were made aware
of the academic standards their differences in reading scores decreased to insignificant levels. This result demonstrates that when the students’ home environment does not match the school environment, their academic achievement may be impacted. Although the focus of the Goudeau and Croizet (2017) article was not specifically about specialization and stress-adapted students, it did demonstrate the importance of the learning context and that school systems can have built-in biases that favor the experiences of one group of students over another.

**Current Study**

The current study tested the relationship between class average grade, stress-adapted students, pedagogical techniques (incorporating ecologically relevant content, using task-shifting activities, and offering immediate rewards) and classroom environment. Data gathered via an Internet-based survey was used to test four hypotheses. My hypotheses were:

**H1**: Stress-Adapted Student Score, Pedagogical Techniques Score, and Classroom Environment Score are all linearly related to Class Average.

- **H1A**: Stress-Adapted Student Score will be negatively related to Class Average
- **H1B**: Pedagogical Techniques Score will be positively related to Class Average
- **H1C**: Classroom Environment Score will be positively related to Class Average

**H2**: Stress-Adapted Student Score, Pedagogical Techniques Score, and Classroom Environment Score, together, can be used to predict Class Average.

**H3**: The interaction between Stress-Adapted Student Score and Pedagogical Techniques score will moderate the relationship between Stress-Adapted Student Score and Class Average.

**H4**: The interaction between Stress-Adapted Student Score and Classroom Environment Score will moderate the relationship between Stress-Adapted Student Score and Class Average.
CHAPTER THREE

METHODS

Participants

Participants included 263 teachers of grades 6 – 12 (mode = 11th grade) who volunteered to take the survey. Three participants indicated they did not wish to participate, 1 participant completed the survey twice, 90 participants partially completed the survey, and 1 participant was excluded because they were not a primary classroom teacher, leaving the final sample size of 168. Participation was limited to lead classroom teachers because participants were asked questions regarding lesson planning, which is typically not a responsibility of a teaching assistant or co-teacher. No teachers were excluded based on years of experience, gender, age, subject taught, race, or ethnicity. Teachers had between 1 and 36 years of experience \( (m = 14.75, SD = 9) \), 4 and 70 students in the class they reported on \( (m = 20) \) and the majority were located in New York \( (n = 117) \) and were teaching a combination of face-to-face and online classes \( (n = 115) \). Information regarding the age, sex, race, and ethnicity was not collected. Detailed information about participant characteristics can be found in Appendix A.

Procedures

Some of the planned procedures for this study were impacted by COVID-19 and associated changes to Institutional Review Board protocol. Instead of collecting data via in-person observations and a post-observation questionnaire, as was originally planned, this study used a 28-question survey distributed electronically via email and social media upon receiving approval from the Institutional Review Board at the University at Albany, SUNY. Qualtrics, an online survey platform that collects, securely stores, and analyzes data, was used to host the survey and collect data (www.qualtrics.com). Emails were sent to individual teachers, leaders of
local chapters of the National Board for Professional Teachers, school administrators, and professors in teacher preparation programs. The survey was also distributed through my personal Facebook page and through posts on Facebook groups for teachers, such as the “Teaching in the Times of Coronavirus” and “MILSpouse Network for Teaching Professionals” pages. When distributed via email and social media, the link to the survey was accompanied by a message explaining that the survey was intended for current teachers of grades 6-12, that questions about teaching style, classroom characteristics, and student demographics were included, and that the survey takes fewer than 10 minutes to complete (See Figure 1). This information was given at the start of the survey and followed by an option to accept or decline to participate (See Figure 2). Upon agreeing to participate, respondents were asked how many class periods they teach per day. Qualtrics randomly chose one class period from options populated by participants and the directions, “For the following questions, please think of the (randomly chosen class number) class you teach each day. If your daily schedule changes, please think of the schedule for the day you taught most recently.” At the conclusion of the survey, participants were given the option to provide their email addresses to enter a chance to win one of three $25 Amazon gift cards, which was provided via email to three randomly selected participants when the survey closed.

This survey was designed for my dissertation research on 6-12 teaching practices, classrooms, and students. I am seeking current teachers of grades 6-12 in any subject, from any state, to participate. The survey will take roughly half an hour to complete and respondents have a chance to win one of three $25 Amazon gift cards. Participant names and responses will be kept confidential. I will use this information to investigate how students who have experienced social and/or financial disadvantage perform in various classroom situations.

Here is my link: Survey for Dissertation Research on 6-12 Teaching Practices and Classrooms

Figure 1: Survey distribution message sent to potential participants via email and social media.
Figure 2: Message to participants included at the start of the survey. The message provides detailed information about the purpose of the survey, the time it takes to complete, what information would be asked, and the option to choose to participate.

Measures

A 28-question Internet-based survey was created for the purposes of this study (See Appendix B). The survey was used to obtain information from teachers regarding their teaching experience and current teaching assignment, pedagogical techniques, classroom environment, students’ exposure to stress, and classroom-level academic achievement. The original survey, intended for use as a post-observation tool (See Appendix C), was piloted to provide evidence of reliability and validity before use. The final version of the survey, which is described below, was not pilot tested, however, many of the questions remained the same.

Questionnaire Pilot. The questionnaire that teachers completed was comprised of questions that are novel to this study. Pilot testing was conducted to establish the validity of the instrument, given that this evidence does not already exist. The content validity of the
questionnaire was established through several think-aloud interviews and pilot testing with teachers who did not participate in the study. During this process, teachers explained what they thought each question was asking and why they thought the question was being asked. For example, in response to the question, “How often do you plan lessons that involve noise or talking?” several teachers indicated that they believed this question was related to their classroom management skills. The question was reworded to read, “In a given week, how often do you plan lessons that involve students talking and interacting with people at the same time? (For example, working in groups, giving answers to problems orally, or otherwise doing activities that do not necessitate a quiet atmosphere.)” My intention was to remove any potential negative connotations that were implied and to provide examples that would help respondents see that the goal of the question was to measure teachers’ facilitation of classrooms where conversation and movement were part of learning, and not a by-product of unwanted student behaviors.

Additionally, teachers were given the opportunity to comment on the ease of completion of the questionnaire and the likelihood that they would be able to provide accurate information about the stress-exposure of their students. Of the seven teachers included in the face-validity pilot, when asked how difficult they would find it to answer the questions about students’ backgrounds, two indicated that they would find this to be very difficult. Both teachers also suggested that they did not believe that most teachers would have the same difficulties and that they were “willfully ignorant” about their students’ backgrounds. The remaining five teachers felt confident in their ability to answer these questions accurately with the help of learning management systems (a software application used to document, track, and report student information such as grades, attendance, individualized educational plans, and emergency
contacts). This feedback was indicative of the fact that teachers from a variety of districts felt that they could accurately answer questions about the backgrounds of their students, therefore justifying the use of teacher-reported information about detailed student demographic information.

I also used this survey for a project in the Survey Methodology course Educational Policy and Leadership 662, during which time I received feedback from the professor about wording, organization, question order, and clarity. The professor is an expert in the field and has published several articles on measurement and survey methodology and serves as the Assistant Director of Assessment and Coordinator of Survey Research for the University at Albany. One suggestion she made was to change the wording of a question so that the answer would be quantitative and so the question was clearer. For example, the question, “How many of your students live in homes with guardians that you find it difficult to contact? (For example, phone numbers are disconnected, messages are not returned, etc.)” was reworded to read, “For how many students in Period X do you have at least one working phone number that you can use to contact parents/guardians?” This change was made because my survey methodology professor believed the word “difficult” was subjective, whereas having one working phone number is both objective and quantifiable. Based on the feedback received from the think-aloud, pilot testing, and survey methodology course, several changes were made (See Appendix D for more details.).

The questionnaire was also adapted to account for changes due to COVID-19. The largest change that resulted from this adjustment is that teachers were asked to provide information about how their answers compare to answers they would have chosen pre-pandemic. For example, after each question related to pedagogical planning, a follow-up question asks: “How does this compare to your pre-COVID-19 classroom?” Response options to this question are: I
do this more often now; I do this less often now; I do this the same amount now as I did pre-COVID-19; and Not Applicable. Furthermore, some question wording was changed to reflect practices found in online learning environments. Whereas the original survey question regarding student movement read, “How often do you plan lessons that involve students moving throughout the classroom? (For example, to different learning stations, different seating arrangements, or to gather materials.), the question now asks, “How often do you plan lessons that involve students moving during class time? (For example, having a stretch break, or using body language or props to engage or answer questions.)

**Pedagogical Techniques.** Three questions about pedagogical techniques asked teachers to estimate how often they planned to use specific pedagogical techniques in one of their classes. These items showed low internal consistency (α = .275). Response options to these items used a 4-point Likert-style scale of 1 (*almost never*), 2 (*rarely*), 3 (*sometimes*) and 4 (*almost always*). The techniques of interest include: *ecologically relevant examples or materials, immediate rewards*, and *task-shifting activities*. The first technique, using *ecologically relevant examples and materials*, are those that connect to students lives and interests outside of school (Tomlinson, 2000; Ellis, Bianchi, Griskeicius, & Frankenhuis, 2017). For example, using sports to frame a math problem or connecting historical events to students’ civic privileges. The item associated with this technique reads: “In this class, how often do you plan to present your content in a way that connects to students’ interests and lives?” The next technique, *immediate rewards*, are rewards that are given very soon after a desired behavior is demonstrated and may take the form of positive verbal feedback, additional privileges, or physical rewards like pencils or candy. This item reads: “In this class, how often do you plan to teach lessons that include some form of immediate rewards (such as verbal praise, additional privileges, or physical rewards like pencils
or candy)? The final technique, task-shifting, or, efficiently switching form one task to another (Mittal et al., 2015), could include moving from one learning activity to another, switching from using one skill to another, or shifting from one form of media to another. This item reads, “In this class, how often do you plan lessons that involve shifting focus from one task to another? (For example, moving from one activity to another, moving from individual work to class discussion, switching from using one skill to another, or moving from one software platform to another.)” The Likert ranking chosen on each of these three items were summed to create the pedagogical technique score, with a minimum possible score of 6 and a maximum of 12. Participants scores ranged from 6 – 12, with a mean score of 10.07 (SD = 1.46).

Classroom environment. Teachers were also asked to provide information about their typical classroom environment, specifically about how much noise and movement they incorporate into learning activities. The two items used to collect data on this read: “In this class, how often do you plan lesson that involves students talking and interacting with multiple people at the same time? (For example, working in groups, giving answers to problems orally, or otherwise doing activities that do not necessitate a quiet atmosphere.); and “In this class, how often do you plan lessons that involve students moving during class time? (For example, having a stretch break, or using body language or props to engage or answer questions.) These items were created because environments that allow for movement and talking may simulate the context in which stress-adapted students developed their skills, and will therefore play to their hidden talents better than quiet, controlled environments (Ellis et al., 2017). As was the case with the pedagogical techniques items, the Likert ranking chosen on these two items were summed to create the classroom environment score, with a minimum possible score of 2 and a maximum of
8. The responses to these two items demonstrated a moderate positive correlation ($r = .47, p < .05$). Participants scores ranged from 2 to 8, with a mean of 4.96 ($SD = 1.53$)

**Stress-Adapted students.** Four items about the stress-exposure of the students in the focus class are included. These items had high internal consistency ($\alpha = .76$). The four items asked teachers to report their best estimate about how many students in each class qualify for free or reduced lunch, live in households that could be considered single-parent households, have at least one working phone number that can be used to contact parents/guardians, and live in homes where English is not the primary language spoken. These items were created for use in this study to measure social and economic disadvantages faced by stress-adapted students, in accordance with what is proposed in evolutionary developmental and educational psychological theory (Ellis, Bianchi, Griskeicius, & Frankenhuis, 2017; Frankenhuis, de Vries, Bianchi, & Ellis, 2019; Angelis, Wilcox, & Baker, 2014; Wilcox, & Angelis, 2011).

A stress-adapted student score was created from the responses provided to these items in four steps. First, the number provided in response to “For how many students in this class do you have at least one working phone number that you can use to contact parents/guardians?” was subtracted from the total number of students in the class to deduce how many students do not have at least one working phone number. This was done so that a higher number indicates an increased possibility of social or economic disadvantage, whereas the original question would provide the opposite information. Next, the number provided in response to each of the four questions was summed (total stress score). This number cannot be used as a final score, as it is relative to the number of students in the class. To account for this, an additional calculation was made: multiply the number of students in the class by four to determine what the maximum score for each class could be (maximum stress score). The final step was to divide the total stress score
by the maximum stress score to create a stress score in the form of a percent, which was reflective of how many students were exposed to stress relative to the number of students in the class. Scores can range from 0% (no students in this class qualify for free or reduced lunch, live in households that could be considered single-parent households, have at least one working phone number that can be used to contact parents/guardians, or live in homes where English is not the primary language spoken) to 100%, (every student in the class qualifies for free or reduced lunch, lives in households that could be considered a single-parent household, does not have at least one working phone number that can be used to contact parents/guardians, and lives in a home where English is not the primary language spoken). For example, if a fictional participant, “Mr. Teacher” says that he has 20 students in his class, and that four of them qualify for free or reduced lunch, three live in single-parent households, one does not have at least one working phone number, and seven live in a household where a language other than English is the primary language spoken, the total stress score for Mr. Teacher’s class is $4 + 3 + 1 + 7 = 15$. The maximum stress score for this class is $20 \times 4 = 80$. The stress-adapted student score in percent will be $(15/80) \times 100 = 18.75\%$. Participants stress-adapted students’ scores ranged from 0% to 85%, with a mean of 29% ($SD = 18.18$).

**Class average.** Information regarding *class average* was gathered through three items. Participants were asked, “What is the current average grade for this class (in percent)? You can use your current gradebook to create this estimate” and “What sources of information did you use to create the class average? Choose all that apply (Homework, Classwork, Tests, Quizzes, Other (Please Specify)). Teachers were also asked to provide the lowest and highest individual student grade (in percent) for the focus class and to characterize the class as: low performing, on average; average; high performing, on average; or, a heterogeneous mix. The current grade (in
percent) provided by the teacher will be used to determine class average. Participants reported classroom averages ranging from 30% to 100%, with a mean of 78.93% ($SD = 11.92\%$).

**Data Analysis Plan and Expected Results**

**Data Preparation.** The data were manually inspected to remove incomplete responses, duplicate responses, and to adjust responses that were incompatible with analysis. For example, some respondents indicated in percent the number of students who receive free or reduced lunch, whereas the question requested a student count. Several respondents indicated that “less than half” or “more than half” of their students met the question criteria. In these cases, I calculated what half of the number of students would be and added or subtracted 1 to create a numeric equivalent for the response provided by the participants. When asked to provide an average grade in percent, some respondents provided letter grades. These were converted into numbers, such that a grade reported as “B-“ was changed to 80, “B” was changed to 85, and “B+” was changed to 88. The 13 cases in which participants responded “I don’t know” to questions were left blank and excluded from analysis. Two respondents indicated that their courses were ungraded and were not included in the analysis.

**Expected Results.** I plan to test the following hypotheses:

H1: Stress-Adapted Student Score, Pedagogical Techniques Score, and Classroom Environment Score are all linearly related to Class Average.

H1A: Stress-Adapted Student Score will be negatively related to Class Average

H1B: Pedagogical Techniques Score will be positively related to Class Average

H1C: Classroom Environment Score will be positively related to Class Average

H2: Stress-Adapted Student Score, Pedagogical Techniques Score, and Classroom Environment Score, together, can be used to predict Class Average.
H3: The interaction between Stress-Adapted Student Score and Pedagogical Techniques score will moderate the relationship between Stress-Adapted Student Score and Class Average.

H4: The interaction between Stress-Adapted Student Score and Classroom Environment Score will moderate the relationship between Stress-Adapted Student Score and Class Average.

**Statistical Analysis.** I used the statistical software suite, Statistical Package for the Social Sciences (SPSS), to conduct the following analyses. I first evaluated the individual relationships between the predictor variables and the outcome variable using a correlation analysis. I expected that Stress-Adapted Student Score will be negatively related to Class Average and that Pedagogical Techniques Score and Classroom Environment score will be positively related to Class Average.

I conducted multiple linear regressions to examine how the three predictor variables of Stress-Adapted Students Score, Pedagogical Techniques Score, Classroom Environment Score together predicted the outcome variable of Class Average. I expected that the relationship between Stress-Adapted Student Score and Class Average would be moderated by Pedagogical Techniques Score and Classroom Environment score such that Class Average would be higher in classes with higher Pedagogical Techniques and Classroom Environment Scores. The multiple regression equation analyzed was:

\[
Class\ Average = b_0 + b_1(\text{Stress-Adapted Student Score}) + b_2(\text{Pedagogical Techniques Score}) + b_3(\text{Classroom Environment Score}) + b_4(\text{Stress-Adapted Student Score} \times \text{Pedagogical Techniques Score}) + b_5(\text{Stress-Adapted Student Score} \times \text{Classroom Environment Score})
\]

**Power Analysis.** An a priori power analysis was conducted in G*Power 3.1 (Faul, Erdfelder, Buchner, & Lang, 2009) to determine the sample size required to find a medium effect for a multiple linear regression. In line with Cohen’s (1998) guidelines for effect size, a medium
effect size of $\hat{r}^2 = 0.15$ was used in this power analysis, although several previous studies of differentiated instruction studies yielded small effect sizes (Valiandes, 2015; Reis, McCoach, Little, Muller, & Kaniskan, 2011). A multiple linear regression fixed model, with Type II error probability calculated at $(1 - \beta) = 0.80$, Type I error probability calculated at $\alpha = 0.05$ and three predictors resulted in a sample size of 119. Including five predictors, to account for the possible need to test interaction effects, resulted in a sample size of 138. The data from this study includes 168 cases and is adequate to detect significant relationships of moderate size if they exist.
CHAPTER FOUR

RESULTS

Preliminary Analyses

Parametric assumptions, including normality, linearity, homoscedasticity, multicollinearity, and outlier detection, were checked. The data did not violate any assumptions. Figure 3 below shows that the residuals are approximately normally distributed. A scatterplot of the residuals shown in Figure 4 indicates that there are no distinct patterns, indicating that the data does not violate the assumption of linearity or homoscedasticity. The variable inflation factor (VIF) was calculated and returned statistics ranging from 1.11 to 1.19, indicating a lack of multicollinearity. Cook’s distances for each case were calculated to determine if any outliers that would influence the model existed in the data. The maximum statistic was .337, indicating that no cases were overly influencing the model. Visual inspections of the data were also used to check for outliers and indicated there were no extreme outliers.

Figure 3: Normal P-P Plot of regression standardized residuals for the outcome variable, Class Average.
Statistical Analyses

**Correlation.** To test H1 (Stress-Adapted Student Score, Pedagogical Techniques Score, and Classroom Environment Score are all linearly related to Class Average), H1A (Stress-Adapted Student Score will be negatively related to Class Average), H1B (Pedagogical Techniques Score will be positively related to Class Average), and H1C (Classroom Environment Score will be positively related to Class Average), I conducted a correlational analysis to evaluate the individual relationships between the predictor variables and the outcome variable. I expected that all three outcome variables would be linearly related to Class Average (H1), that Stress-Adapted Student Score will be negatively related to Class Average (H1A), and that Pedagogical Techniques Score (H1B) and Classroom Environment Score (H1C) would be positively related to Class Average. Results from the analysis indicate that Pedagogical Techniques Score is not correlated with Class Average ($r(166) = -0.09, p > .05$). However, both Stress-Adapted Student Score ($r(166) = -0.52, p < .05$) and Classroom Environment Score ($r(166) = 0.16, p < .05$), were linearly related to Class Average in the hypothesized directions. Therefore, the data partially supports H1, fully supports H1A and H1C, but does not support H1B (see Table 1 and Figures 5, 6, and 7).
Table 1

*Correlations Between Study Variables*

<table>
<thead>
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<th>1</th>
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<th>3</th>
<th>4</th>
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<tbody>
<tr>
<td>1. Class Average</td>
<td>----</td>
<td>-------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>2. Stress-Adapted Student Score</td>
<td>-.52*</td>
<td>----</td>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td>3. Classroom Environment Score</td>
<td>.16*</td>
<td>-.12</td>
<td>----</td>
<td>-----</td>
</tr>
<tr>
<td>4. Pedagogical Techniques Score</td>
<td>-.09</td>
<td>.19*</td>
<td>.32*</td>
<td>----</td>
</tr>
</tbody>
</table>

*p < .05

Figure 5: Scatterplot of the relationship between Stress-Adapted Student Score and Class Average.
Figure 6: Scatterplot of the relationship between Classroom Environment Score and Class Average.

Figure 7: Scatterplot of the relationship between Pedagogical Techniques Score and Class Average.
**Multiple linear regression.** To test H2 (Stress-Adapted Student Score, Pedagogical Techniques Score, and Classroom Environment Score, together, can be used to predict Class Average), a multiple linear regression of the relationship between Stress-Adapted Student Score, Pedagogical Techniques Score, Classroom Environment Score and the dependent variable, Class Average was tested. The results show that there was no significant association between Pedagogical Techniques Score and Class Average, while holding Stress-Adapted Student Score and Classroom Environment Score constant \( b = -0.15, \beta = -0.02, t(162) = -0.26, p > .05 \) or Classroom Environment Score and Class Average, while holding Pedagogical Techniques Score and Stress-Adapted Students Score constant \( b = 0.84, \beta = 0.12, t(162) = 1.51, p > .05 \). However, a significant negative relationship between Stress-Adapted Score and Class Average, while holding Pedagogical Techniques Score and Classroom Environment Score constant, was evident \( b = -0.33, \beta = -0.50 t(162) = -7.06, p < .05 \). The results indicate that a higher Stress-Adapted Student Score is associated with a lower Class Average. This means that on average, for classrooms with a Stress-Adapted Student Score that was 10% larger, the Class Average was 3.3 points lower. The model results indicated that the data explained 28% of the variance in Class Average and was a significant predictor of Class Average \( R^2 = .28, R_{Adj.}^2 = .27, F(3, 183) = 21.06, p < .05 \). The results from this analysis, which can be found in Table 2, provide partial support for H2.

**Table 2**

*Regression Coefficients for Predictors of Class Average*

<table>
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<tr>
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<th>( b )</th>
<th>( \beta )</th>
<th>( t )</th>
<th>( p )</th>
<th>( \text{Partial } r )</th>
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</thead>
<tbody>
<tr>
<td>Constant</td>
<td>86.31</td>
<td></td>
<td>15.43</td>
<td>.00</td>
<td></td>
</tr>
<tr>
<td>Stress-Adapted Student Score</td>
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<td>-0.50</td>
<td>-7.26</td>
<td>.00</td>
<td>-.49</td>
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<tr>
<td>Classroom Environment Score</td>
<td>0.83</td>
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<td>1.50</td>
<td>.14</td>
<td>.12</td>
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<tr>
<td>Pedagogical Techniques Score</td>
<td>-0.19</td>
<td>-0.02</td>
<td>-0.32</td>
<td>.75</td>
<td>-0.03</td>
</tr>
</tbody>
</table>

Note. \( R^2 = .28, n = 168 \)
To test H3 (The interaction between Stress-Adapted Student Score and Pedagogical Techniques score will moderate the relationship between Stress-Adapted Student Score and Class Average) a moderation analysis was conducted. The results of a moderation analysis indicate that Pedagogical Technique Score did not moderate the relationship between Stress-Adapted Student Score and Class Average, while holding Classroom Environment Score constant \[b = 0.03, \beta = 0.06, t(163) = 0.94, p > .05\]. The model results indicated that the inclusion of the interaction term did not explain any additional variability in Class Average than the model tested for H2. The results from this analysis do not provide support for H3 (see Table 3).

Table 3

*Regression Coefficients for the Relationship Between Stress-Adapted Student Score and Class Average with Pedagogical Techniques Score as a Moderator*

<table>
<thead>
<tr>
<th>Variables</th>
<th>(b)</th>
<th>(\beta)</th>
<th>(t)</th>
<th>(p)</th>
<th>Partial (r)</th>
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</tr>
<tr>
<td>Stress-Adapted Student Score</td>
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</tr>
<tr>
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<td>.12</td>
</tr>
<tr>
<td>Pedagogical Techniques Score</td>
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<td>-.02</td>
<td>-0.27</td>
<td>.79</td>
<td>-.02</td>
</tr>
<tr>
<td>Stress-Adapted Student Score x Pedagogical Techniques Score</td>
<td>0.03</td>
<td>.06</td>
<td>.96</td>
<td>.35</td>
<td>.07</td>
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</tbody>
</table>

Note. \(R^2 = .28, n = 168\)

To test H4 (The interaction between Stress-Adapted Student Score and Classroom Environment Score will moderate the relationship between Stress-Adapted Student Score and Class Average), a second moderation analysis was conducted. The results indicates that Classroom Environment Score did not moderate the relationship between Stress-Adapted Student Score and Class Average, while holding Pedagogical Techniques Score constant \[b = -0.01, \beta = -0.01, t(163) = -0.48, p > .05\]. The inclusion of this interaction effect in the model explained no more of the variability in Class Average than the model used to test H2 (see Table 4). Thus, H4 was not supported by the data.
Table 4

Regression Coefficients for the Relationship between Stress-Adapted Student Score and Class Average with Classroom Environment Score as a Moderator

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<td>-.49</td>
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<td>Stress-Adapted Student Score x Classroom</td>
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<td>-.48</td>
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<td>-.03</td>
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<tr>
<td>Environment Score</td>
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</table>

Note. \( R^2 = .28, n = 168 \)

**Results Summary**

The results of a correlation analysis indicate that a linear relationship exists between Stress-Adapted Student Score and Class Average (\( r(166) = -.52, p < .05 \)), and Classroom Environment Score and Class Average (\( r(166) = .16, p < .05 \)), but not between Pedagogical Techniques Score and Class Average (\( r(166) = -.09, p > .05 \)). The results of a Multiple Linear Regression show that Pedagogical Techniques Score [\( b = -0.15, \beta = -.02, t(162) = -0.26, p > .05 \)] and Classroom Environment Score [\( b = 0.84, \beta = .12, t(162) = 1.51, p > .05 \)], while controlling for all independent variables, were not significant predictors of Class Average. The parallel analysis also showed that Stress-Adapted Student Score was a significant negative predictor of Class Average, while holding the other independent variables constant [\( b = -0.325, \beta = -.495, t(162) = -7.06, p < .05 \)]. Finally, the results of two moderation analysis show that Pedagogical Techniques Score [\( b = 0.03, \beta = .06, t(163) = 0.94, p > .05 \)] and Classroom Environment Score [\( b = -0.01, \beta = -.01, t(163) = -0.48, p > .05 \)] did not moderate the relationship between Stress-Adapted Student Score and Class Average.
CHAPTER FIVE

DISCUSSION

This study was designed to investigate if students who have been exposed to stress perform better in classes where teachers play to the strengths of stress-adapted students by using specific pedagogical techniques in specific classroom environments. Keeping in mind the sensitization and specialization hypotheses, the objective of this study was to analyze how the ways that teachers instruct, combined with the environments in which they give this instruction, can together impact the academic achievement of students who have experienced social and economic disadvantage.

I hypothesized that teachers who incorporated ecologically relevant content, used task-shifting activities, and offered immediate rewards would have classes with higher class average grades. I also hypothesized that teachers who allowed for more noise and movement as part of learning activities would have higher average class grades. Finally, I hypothesized that classes with higher numbers of stress-adapted students would have lower class averages, but that this relationship would be moderated by the three aforementioned teaching techniques and presence of noise and movement in the classroom.

I originally intended to investigate these relationships using observational and survey data, but I was unable to do so because of the COVID-19 pandemic and a change of IRB protocol prohibiting in-person data collection. Instead, this study used survey results from teachers who provided information about their teaching techniques, classroom environments, student demographics, and class average grades. I have no doubt that the COVID-19 pandemic impacted more than just the methodology of my research. Several recent studies highlight how teachers, students, and educational systems have been negatively impacted by changes resulting from the pandemic crisis (Drane, Vernon, & O’Shea, 2020; Andrew et al., 2020; Artiga, Orgera,
Pham, & Corallo, 2020; Nordengren, & Jensen, 2020). In the discussion that follows, I will assume this is evident and that there is no need to further highlight this important detail.

Summary of Major Findings

I found that having stress-adapted students was significantly related to a decrease in class average. Classrooms with higher levels of noise and movement were positively correlated with class average, but the use of the specified pedagogical techniques was not related to class average. Finally, the relationship between the presence of stress-adapted students and class average was not impacted by teaching techniques or classroom environment.

Detailed Summary of Findings

Hypothesis 1.

**Stress-Adapted Student Score.** The correlational analysis showed a significant linear relationship between Stress-Adapted Student Score and Class Average, showing support for subhypothesis H1A. On Average, classes that had a higher percentage of students exposed to social and economic stressors (being qualified for free or reduced priced lunch, living in single-parent homes, speaking a language other than English in their home, and having no working method of parent communication) tended to have lower class average grades. This is consistent with research on “at-risk” students that shows traditional indicators of socioeconomic status (maternal education, household income, maternal occupation, student qualification for free or reduced priced lunch) are associated with academic achievement (such as, performance on standardized math and reading tests, graduation rates) (Sirin, 2005). Although the measure of social and economic disadvantage used in this study was not traditional (qualification for free or reduced priced lunch, maternal income, and maternal education), it was informed by research in the fields of educational psychology and evolutionary developmental psychology and was
crafted to include information that could be provided by teachers, rather than the parents or students themselves.

For example, research from the field of educational psychology on “high-risk” students has found that students whose families speak a language other than English as their primary language, live in poverty and qualify for free or reduced lunch are less likely to graduate high school (Angelis, Wilcox, & Baker, 2014). Work from evolutionary developmental psychologists who study “stress-adapted” students use markers of social and economic disadvantage, such as maternal investment, family income, and familial make up to operationalize stress exposure (Ellis, Bianchi, Griskevicius, & Frankenhuis, 2017; Suor, Sturge-Apple, Davies, & Cicchetti, 2017). This study combined the characteristics described in both fields and relied on indicators that were consistent across the research and addressed both social and economic disadvantage. Indicators like maternal education that would be difficult for teachers to know were left out. Maternal investment (which is easier to study than familial investment because children most often live with their mothers) is measured here deductively by asking teachers if they have working phone numbers for the student’s home. The resulting measure of possible stressors was pilot-tested to ensure that teachers would be able to provide the information requested about their students. Most of the teachers involved in the pilot indicated that they would know how many of their students qualified for free or reduced priced lunch, live in single-parent homes, speak a language other than English in their home, or if they have no working method of communication with the student’s family. These items had high internal consistency ($\alpha = .76$), indicating that the measure was reliable.

Classroom Environment Score. A significant linear relationship was also found between the amount of noise and movement present in the classroom and the class average grade, which
supports hypothesis H1C. Teachers who reported planning lessons that involved students talking and interacting with multiple people and moving during class time had higher class averages. This finding supports ideas proposed by proponents of differentiated instruction who encourage teachers to adjust the learning environment to have both quiet and collaborative areas and acknowledge that some students learn better with movement (Tomlinson, 2000).

**Pedagogical Techniques Score.** No significant linear relationship was found between teaching techniques and class average. The use of content relevant to students lives, task-shifting, and providing immediate rewards had no relationship with class average. This finding is inconsistent with the assertions made by proponents of differentiated instruction (Tomlinson, 2000) and the hidden-talents approach to understanding stress-adapted students (Ellis, et al., 2017). This inconsistency may be related to the fact that the majority of teachers \( n = 115 \) in the study were teaching both face-to-face and online students, which is a relatively new teaching modality for most K-12 teachers. Although they may be planning to use teaching techniques that should improve academic success in their classes, they may not be executing the techniques as well as they would in a classroom setting they were more familiar with.

It is worth noting that some studies have found that students from low socioeconomic status backgrounds performed worse on questions that were meant to be ecologically relevant (relating to money) when compared to questions that were not ecologically relevant (purely mathematical) (Muskins, 2019). Ecological relevance can take the form of content, as was the case in the present study and Muskins (2019), but it can also refer to the format of the assessment. It may be necessary to investigate the multiple ways in which education can be made to be ecologically relevant to students beyond focusing on content alone.

**Hypothesis 2.**
Predicting Class Average. Of the three predictors tested (Pedagogical Techniques Score, Classroom Environment Score, Stress-Adapted Student Score), only Stress-Adapted Student Score was a significant predictor of Class Average, while accounting for the other predictor variables. As was alluded to in the correlational analysis, classes with a larger number of students exposed to stressors, on average, tended to have lower class average grades. Although the noise and movement present in the classrooms was significantly related to the class average in the correlation analysis, when included in the regression analysis with the other predictors, the influence of noise and movement was no longer significant.

I expected that teachers who reported using the teaching techniques of interest more would have higher class averages, even while controlling for the percentage of students exposed to stressors and the classroom environment. I also expected that in classrooms where teachers incorporated noise and movement into the learning environment that class averages would be higher, while controlling for the percentages of students exposed to stressors experienced and the teaching techniques used. Neither of these expectations was supported by my data. It could be that even though teachers are using teaching techniques and creating classroom environments that support stress-adapted students, that the effects of their efforts are washed out by counter-effects created by a change in teaching modality. The impact that social and economic disadvantages may be highlighted for students who are learning from home. For example, students who live in homes in which English is not the primary language spoken may lose English language proficiency as their exposure to native speakers declines. English language learners typically develop social vocabulary before academic vocabulary. Students without advanced fluency could find the transition to online learning very difficult, as their main source of practice (socializing) has been drastically reduced (Hill & Miller, 2013).
Furthermore, access to consistent high-speed internet and computers with large processing capacities necessary to run several Internet-based learning programs simultaneously is likely a challenge for students who qualify for free or reduced priced lunch. Teachers in this study had, on average, 20 students in their classes ($sd = 9$) and an average of 9 students ($sd = 8$) who qualified for free or reduced lunch. Additionally, 55% of teachers indicated that they almost always planned task-shifting activities, including moving from one software platform to another. This could mean that although teachers were structuring lessons that would theoretically improve stress-adapted student performance, what they were doing could have actually hindered a student’s ability to succeed, especially if the student does not have access to the right technological resources.

**Hypothesis 3.**

*Pedagogical Techniques Score as a Moderator.* The use of ecologically relevant content, task-shifting, and immediate rewards did not change the relationship between the percentage of students exposed to stress and the class average grade. I hypothesized that in classrooms where teachers reported using these techniques more often, the negative relationship between the percentage of students exposed to stressors and the class average grade would decrease in strength. The data did not support my hypothesis.

A key guideline of differentiated instruction suggests that teachers should incorporate material that relates to students lives and interests (Tomlinson, 2000), and this assertion is supported by researchers who believe in the “hidden-talents” of stress-adapted students (Ellis, et al., 2017). Furthermore, empirical evidence suggests that individuals who have experienced social and economic disadvantage may have enhanced task-shifting abilities (Mittal et al., 2015) and be more responsive to immediate rewards (Griskevicius, Tybur, Delton, & Robertson, 2011).
than students who have experienced fewer social and economic disadvantages. The questions used to create the Pedagogical Techniques Score tested in this moderation were created with this evidence in mind, and to account for the specialization hypothesis, which suggests that individuals will adapt to their developmental environment, such that they are better able to solve problems relevant to their immediate ecological surroundings. (Ellis, et al., 2017) Although a wide variety of cognitive, behavioral, and emotional “hidden talents” may develop due to specialization, I chose three that I thought would be easily observed in a classroom situation and potentially related to academic outcomes. For example, research in this area shows that individuals from harsh and unpredictable environments (which have similar qualities to environments associated with social and economic disadvantage) are better able to accurately and quickly identify angry faces (Pollak, Messner, Kistler, & Cohn, 2009). I did not try to incorporate that concept into my survey questions because it seemed unrelated to academic achievement, and so, irrelevant for the purposes of this study. In making the decision to focus on specific specialization skills, it could be that the ones I focused on were not evident in my sample, or maybe not the most appropriate. For example, the research on which I based my decisions was conducted with children (younger than five) and adults (over 18) and so it could be that specialized skills are related to developmental timing. The “hidden talents” demonstrated by adolescents could be different than those demonstrated by children or adults and not captured in my measure.

Furthermore, it could be that the skills I focused on were not related to the stressors I measured. Frankenhuis, Young, and Ellis (2020) suggest that variation in early life stressors will result in variation in later cognitive development. For example, early exposure to physical abuse is associated with increased accuracy and speed at detecting angry faced (Pollak, Messner,
Kistler, & Cohn, 2009), but the same outcome might not occur in an individual who experienced economic poverty without abuse. It may be that the three facets of learning I focused on (task-shifting, responding to immediate rewards, and responding to ecologically relevant content) are not related the stressors I measured (qualifying for free or reduced-price lunch, having a single-parent household, having a household that speaks a language other than English as its primary language, and lacking a working method of communication with the teacher).

Finally, the measure that I created to capture the “hidden talents” of the stress-adapted students present in the classrooms of my participants was a deductive, not a direct measure. I was unable to assess the cognitive skills of students quantitatively or individually, which would have been a more accurate measure. Instead, I asked teachers to report how often they planned to use techniques that I believe play to the strengths that stress-adapted students in their classes might have. For example, I asked teachers how often they planned lessons that involved shifting focus from one task to another, moving from one activity to another, moving from individual work to class discussion, switching from using one skill to another, or moving from one software platform to another. The assumption here is that if the teacher had students who had experienced a high number of stressors, that those students might be better at task-shifting. If the teacher was planning lessons that capitalized on task-shifting ability, then this might be evident as an increase in class average grade despite the presence of stress-adapted students in the class. The insignificant impact of pedagogical techniques on the relationship between stress-adapted students and class average could be due to the indirect means of measuring the “hidden talents” of the stress-adapted students.

**Hypothesis 4.**
Classroom Environment Score as a Moderator. The inclusion of noise and movement in the classroom environment did not change the relationship between the percentage of students exposed to stress and the class average grade. I hypothesized that in classrooms where teachers reported planning to include more noise and movement, the negative relationship between percentage of students exposed to stressors and class average grade would decrease in strength.

The two questions used to measure Classroom Environment Score were originally worded in such a way that they would not have been applicable to virtual learning environments. Although I changed the wording of the questions, the theoretical reasoning in asking the questions became less clear. The Classroom Environment items were designed to account for the sensitization hypothesis, which asserts that individuals will be able to best demonstrate their cognitive adaptations when the environment they are functioning in matches the environment they developed in (Ellis et al., 2017). The sensitization hypothesis is based on the idea that students leave their homes and go to schools to learn, and that with stress-adapted students, a mismatch in developmental and functioning environments occurs. For example, students who experience social and economic disadvantage may live in homes with extended families, or apartment buildings where the lives of others can always be heard. A student from this environment may perform better when tested in a similarly loud or lively environment, which is not standard practice during tests in school. This past year, the overwhelming majority of students developmental environment became their functioning environment as a result of the switch to online education from home. This shift created a unique scenario worthy of study, but it was not the scenario that I intended to investigate the sensitization hypotheses within. Therefore, the measure of Classroom Environment may not have been valid given the fact that it is based on a theoretical concept assuming that children learn in schools, not in their homes.
Implications of Current Study

Based on the results of this study, it is clear that social and economic disadvantages impact student learning. This fact was well-established in pre-COVID 19 educational studies, and is still evident now. Previous studies have focused on how students who grow up in adverse environments struggle academically in traditional face-to-face classrooms (Angelis, Wilcox, & Baker, 2014; Sirin, 2005). This study builds on this work by demonstrating that the same relationship exists when students are learning in their homes.

The shift to online education may even accentuate the disadvantages faced by stress-adapted students. One recent study found that there was a significant relationship between neighborhood median socioeconomic status (SES) and search queries for parent-centered online learning resources, indicating that in neighborhoods with above-median SES search intensity was twice as high than in neighborhoods with below-median SES (Bacher-Hicks, Goodman, & Mulhern, 2021). This trend could be due to parental investment in education, or household access to and/or awareness of Internet resources, among other things. A survey conducted by the Pew Research Center in April of 2020 shows that lower income parents are much more concerned than middle- and high-income parents that their children will fall behind in school because of school closures (Horowitz, 2020). When considered together, the results of this study and others conducted during the COVID-19 pandemic, suggest that there is a relationship between social and economic disadvantage and academic success, and that this relationship may be accentuated by a lack of in-home access to educational resources.

Limitations

One limitation of this study is that the information about the stress exposure of students was provided by teachers. During pilot testing of the survey, the majority of teachers indicated
that they would be able to accurately provide the information asked about their students’ backgrounds. However, it is reasonable to believe that teachers may be less informed about their students’ home lives due to a rise in absenteeism and the physical and social-emotional distance created by a shift to online learning. Although many schools share information about students gathered from teachers, administrators, guidance counselors via learning management systems that document, track, and report student information such as grades, attendance, individualized education plans and communication records, it is likely that even these pooled sources of information were less reliable at this time.

A second limitation of this study is that self-report data about teaching practices without observational data as a cross-reference is less reliable. Whereas observations of teaching practices aren’t without bias, there are many systems available to increase reliability and validity of observations. In this study, I attempted to demonstrate reliability and validity for my survey via several steps of pilot testing. However, there may be a discrepancy between what a teacher plans to do and what they actually do. Furthermore, my original study design incorporated a validity check of teachers’ reports about the number of students exposed to stressors. I had planned to observe teachers in one school district and to randomly choose 10% of classrooms to check teacher reports against guidance counselor reports in order to validate the accuracy of teachers’ responses to those questions. When my study method changed and my sample was not pulled from one district, this validity check was no longer an option.

Another limitation of this study is that all of my variables were based on classes, rather than individual students. As a result, there was limited variability in the Class Average measure. If I had gathered individual student class average grades, I might have been able to detect a relationship between my variables that was undetectable due to a restricted range. My data
showed that Class Average had a $m = 79\%$ and $sd = 12$. This means that roughly 68% of the Class Average scores in my data were between 67% and 91%. Consequently, my data represents scored skewed to the higher end of possible class average grades and if the influence of teaching techniques and class environment were stronger with lower performing students, I may not have the range of scores necessary to demonstrate that.

My survey did not ask teachers to report about the special education needs of their students, or whether their classes featured a special education co-teacher or teaching assistant. In neglecting to gather this information, I was not able to account for this as a potential confound in my study. Furthermore, the results of this study cannot be generalized to students with special education needs or special education teachers and their classes because I do not know how well that population was represented in my data. Finally, students who are stress-adapted and also have special education needs might not respond the same way to the pedagogical techniques and classroom environments I suggest. For example, students with sensory processing sensitivities may not perform better in classrooms with noise and movement, even if they have been stress-exposed.

Another way in which this study was limited is that I asked questions about current environmental stressors, rather than early life stressors, and the two are different from an evolutionary developmental perspective. Although both timings of stress-exposure are hypothesized to impact and potentially enhance certain cognitive skills (Frankenhuis, Ellis, Young, 2020), I should have been clearer about this distinction during the development of this study. Measuring early life stress-exposure is in line with the specialization hypothesis, whereas measuring current stressors would not offer support for that hypothesis, only support for the sensitization hypothesis. Furthermore, the “hidden talents” approach is based on the idea that
individuals develop adaptive responses to adversity in order to improve their functioning in harsh and unpredictable environments. As such, this study would be improved by measuring both early life and current environmental stressors.

**Future Directions**

Future research on the “hidden talents” of stress-adapted students should investigate a variety of interaction patterns. For example, because students who are exposed to stress may develop some enhanced cognitive functions and some impaired cognitive functions simultaneously, it would be helpful to compare how the relationship between stress exposure and cognitive development changes based on the cognitive skill examine. Furthermore, it would be useful to test both within groups (stress-adapted students compared to themselves) and between groups (stress-adapted students compared to students who were not stress-exposed). Analysis conducting in this way might show that stress-adapted students perform better in classroom where teachers use techniques that play to their strengths when compared to classrooms where teachers don’t use such techniques. It may be that the “hidden talents” of these students might be evident in a within group comparison, but because stress-exposure is both enhancing and damaging, a between group comparison might hide potential cognitive enhancements.

It would also be important to gather data on teaching practices and classroom environments using observational data. Observations of teaching show what *actually* happened, not what was planned or what was *supposed* to happen. Teaching is an organic and dynamic process and lesson plans are often adapted on the spot to account for student interests and understanding relative to the content. Although observations can make teachers and students nervous and impact the ecological validity of the data, multiple observations might decrease this
issue while providing more accurate information about pedagogical techniques and classroom environments (Debnam, Pas, Bottiani, Cash, & Bradshaw, 2015).

Finally, future research on teaching practices and classroom environments should consider the teaching modality most familiar to the teacher. For example, teachers who have taught for many years in person and have only recently made the shift to online teaching might not be familiar enough with the new situation to have their pedagogical practices analyzed without a consideration for the potential influence of the new modality confound. Although the teachers’ approach might not change (they may still wish to connect their content to the lives of their students or incorporate group and problem-solving activities) their ability to do these things in a new modality could be developing. The best way to study how pedagogical practices and classroom environments impact the academic achievement of stress-adapted students would be to study teachers and students in classrooms that were typical and familiar to both the teacher and the students.

**Conclusions**

Student exposure to stress continues to have a negative influence on academic achievement. In this study, higher numbers of students exposed to stress was significantly related to lower class average grades. Although teaching in ways that play to the “hidden talents” of stress-adapted students may mitigate the effects of stress-exposure, it was not demonstrated in this study. However, it could be that the relationship between stress-exposure and class average could have been stronger that it was, given that compulsory online learning may exacerbate the impact of social and economic disadvantage faced by stress-adapted students.
References


Artiga, S., Orgera, K., Pham, O., & Corallo, B. (2020). Growing data underscore that communities of color are being harder hit by COVID-19. Kaiser Family Foundation.


Hill, J., & Miller, K. B. (2013). Classroom instruction that works with English language learners. ASCD.


Appendices

Appendix A: Detailed Information on Study Participants

Table A1

Descriptive Statistics of Participants

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Table B1

Participant Characteristics by Frequency and Percent

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<td>9th</td>
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<td>12th</td>
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<td>Music</td>
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<td>4.8</td>
<td>55.4</td>
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<tr>
<td>Other</td>
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<td>6.5</td>
<td>61.9</td>
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<tr>
<td>Physical Education</td>
<td>3</td>
<td>1.8</td>
<td>63.7</td>
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<tr>
<td>Characteristics</td>
<td>Frequency</td>
<td>Percent</td>
<td>Cumulative</td>
</tr>
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<td>--------------------------</td>
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<td>Special Education</td>
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<td>4.2</td>
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<tr>
<td>Social Studies</td>
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<td>16.1</td>
<td>100</td>
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<tr>
<td>Teaching Modality</td>
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<td>.6</td>
<td>.6</td>
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<td>Online Synchronous</td>
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<td>24.4</td>
<td>25.1</td>
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<tr>
<td>Face-to-Face</td>
<td>10</td>
<td>6.0</td>
<td>31.1</td>
</tr>
<tr>
<td>Combination of Online and Face-to-Face</td>
<td>115</td>
<td>68.5</td>
<td>100</td>
</tr>
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</table>
Thank you very much for participating in my dissertation research and completing this survey. Like you, I am a teacher and I know just how valuable every bit of your time is.

If you are a primary classroom teacher (you participate in planning and teaching daily) currently working with grades 6-12, I would love to have you participate in my research.

In the 28 questions that follow, I will ask you to tell me information about yourself relating to your teaching techniques and classroom environment. I will also ask you for information about your students, such as their socioeconomic status and class grade point average. I will use this information to investigate how students who have experienced social and/or financial disadvantage perform in various classroom situations.

This should take about half an hour to complete. All participants who submit a completed survey will be entered into a drawing for a chance to win one of four $25 Amazon gift cards.

Do you agree to participate in this research?

☐ Yes

☐ No

End of Block: Agree

Start of Block: Intro Questions

What is your first and last name? (This information will be disassociated from your responses and will not be connected to specific schools, districts, etc.)
What is your email address? (You only have to provide this information if you wish to be added to the Amazon gift card drawing.)

________________________________________________________________

In what state are you currently teaching?

________________________________________________________________

[*]

How many years have you been a teacher? Please round to the nearest whole number.

________________________________________________________________

How many classes do you teach in a day? If you don't teach the same number of classes each day, please provide an average.

☐ 1
☐ 2
☐ 3
☐ 4
☐ 5
☐ 6

End of Block: Intro Questions

Start of Block: First Class
(For the remainder of the survey, respondents are asked to think about only one of their classes. Respondents are shown the prompt below, with a randomly chosen class indicated in bold.)

For the following questions, please think of the **first class** you teach each day. If your daily schedule changes, please think of the schedule for the day you taught most recently.

---

**Start of Block: Period 1**

What subject do you for the class you are thinking of? If you teach freshmen English, just give the subject, not the grade level (respond, English).

---

Which best describes the class you are thinking of?

- Online Asynchronous (the students and teachers do not meet at prearranged times for class)
- Online Synchronous (the students and teachers meet at prearranged times for class)
- Face-to-Face
- A combination of online and face-to-face

---

How might you characterize this class?

- Low performing, on average
- Average
- High performing, on average
- A heterogeneous mix
In what grade are the majority of students in this class?

- 6th
- 7th
- 8th
- 9th
- 10th
- 11th
- 12th

How many students are in this class?

________________________________________________________________

How many students in this class qualify for free or reduced lunch? If you are uncertain, please provide your best estimate.

________________________________________________________________

How many of the students in this class live in households that could be considered single-parent households? If you are uncertain, please provide your best estimate.

________________________________________________________________

For how many students in this class do you have at least one working phone number that you can use to contact parents/guardians? If you are uncertain, please provide your best estimate.

________________________________________________________________
How many students in this class live in homes where English is not the primary language spoken? If you are uncertain, please provide your best estimate.

__________________________________________________________________________

What is the current average grade (in percent) for this class? You can use your current gradebook to create this estimate.

__________________________________________________________________________

What sources of information did you use to create the class average? Choose all that apply.

☐ Homework
☐ Classwork
☐ Tests
☐ Quizzes
☐ Other ______________________________________________________________

__________________________________________________________________________

What is the lowest individual student grade (in percent) in this class?

__________________________________________________________________________

What is the highest individual student grade (in percent) in this class?

__________________________________________________________________________
Please answer the following questions using this scale:
1- Almost Never
2- Rarely
3- Sometimes
4- Almost Always

In this class, how often do you plan lesson that involves students talking and interacting with multiple people at the same time? (For example, working in groups, giving answers to problems orally, or otherwise doing activities that do not necessitate a quiet atmosphere.)

☐ 1 (Almost Never)
☐ 2 (Rarely)
☐ 3 (Sometimes)
☐ 4 (Almost Always)

How does this compare to your typical, pre-COVID19 classroom?

☐ I do this more often now
☐ I do this less often now
☐ I do this the same amount now as I did pre-COVID19
☐ Not Applicable
In this class, how often do you plan lessons that involve students moving during class time? (For example, having a stretch break, or using body language or props to engage or answer questions.)

- 1 (Almost Never)
- 2 (Rarely)
- 3 (Sometimes)
- 4 (Almost Always)

How does this compare to your typical, pre-COVID19 classroom?

- I do this more often now
- I do this less often now
- I do this the same amount now as I did pre-COVID19
- Not Applicable

In this class, how often do you plan lessons that involve shifting focus from one task to another? (For example, moving from one activity to another, moving from individual work to class discussion, switching from using one skill to another, or moving from one software platform to another.)

- 1 (Almost Never)
- 2 (Rarely)
- 3 (Sometimes)
- 4 (Almost Always)
How does this compare to your typical, pre-COVID19 classroom?

○ I do this more often now

○ I do this less often now

○ I do this the same amount now as I did pre-COVID19

○ Not Applicable

-----------------------------------------------

In this class, how often do you plan to present your content in a way that connects to students' interests and lives?

○ 1 (Almost Never)

○ 2 (Rarely)

○ 3 (Sometimes)

○ 4 (Almost Always)

-----------------------------------------------

How does this compare to your typical, pre-COVID19 classroom?

○ I do this more often now

○ I do this less often now

○ I do this the same amount now as I did pre-COVID19

○ Not Applicable

-----------------------------------------------
In this class, how often do you plan to teach lessons that include some form of immediate rewards (such as verbal praise, additional privileges, or physical rewards like pencils or candy)?

- 1 (Almost Never)
- 2 (Rarely)
- 3 (Sometimes)
- 4 (Almost Always)

How does this compare to your typical, pre-COVID19 classroom?

- I do this more often now
- I do this less often now
- I do this the same amount now as I did pre-COVID19
- Not Applicable
Appendix C: Original Teacher Survey

Demographics

Name

Please tell me what subjects you are currently teaching and the corresponding grade level for each subject.

Excluding the current year, please tell me how many years you have been teaching.

Pedagogy

In one week, how often do you plan to teach lessons that include some form of immediate feedback (verbal or written)?

In one week, how often do you plan to use content that is ecologically relevant? (That is, material that connects to the students’ interests and lives)

In one week, how often do you plan lessons that involve switching between tasks? (That is, lessons that have several activities or components)

In one week, how often do you plan lessons that involve students talking and interacting with multiple people at the same time? (For example, group discussions, group tasks, or any activities that don’t necessitate a quiet atmosphere)

In one week, how often do you plan lessons that involve students moving throughout the classroom? (For example, to different learning stations, or different seating arrangements.)

Student Information

How many students are in your class?

How many of your students receive free or reduced lunch?

How many of your students live in homes that do not feature two parents?

How many of your students live in homes with guardians that you find it difficult to make contact with? (For example, phone numbers are disconnected, messages are not returned, etc.)

How many of your students live in homes where English is not the primary language used?

Academic Information

What is the current class average (in percent) for each of your classes? You can estimate this based on your current gradebook.

What sources of information did you use to create this average? Please explain quantity and type. For example, you might have 3 homework grades, 2 classwork grades, and 1 exam to base your classroom average on.
# Appendix D: Feedback from Pilot Testing of the Survey

<table>
<thead>
<tr>
<th>Original Question</th>
<th>Feedback from Face-Validity Pilot with Teachers</th>
<th>Feedback from Pilot with Survey Methodology class</th>
<th>Final Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Clarify first/last name</td>
<td></td>
<td>What is your first and last name?</td>
</tr>
<tr>
<td>Please tell me what subjects you are currently teaching and the corresponding grade level for each subject.</td>
<td></td>
<td></td>
<td>What subject do you teach in Period 1? If you teach freshmen English, just give the subject, not the grade level (respond, English). In what grade are the majority of students in your Period 1 class? 9th 10th 11th 12th</td>
</tr>
<tr>
<td>Excluding the current year, please tell me how many years you have been teaching.</td>
<td></td>
<td></td>
<td>Excluding the current year, for how many years have you been teaching? 0 - 3 years 4 - 7 years 8 - 11 years 12 - 15 years More than 15 years</td>
</tr>
<tr>
<td>In one week, how often do you plan to teach lessons that include some form of immediate feedback (verbal or written)? Does it matter if the feedback is positive or negative? Does handing back a graded paper count?</td>
<td></td>
<td></td>
<td>In a given week, how often do you plan to teach lessons that include some form of immediate rewards (such as verbal praise, additional privileges, or</td>
</tr>
</tbody>
</table>

74
<table>
<thead>
<tr>
<th>Question</th>
<th>1 (Almost Never)</th>
<th>2 (Rarely)</th>
<th>3 (Sometimes)</th>
<th>4 (Almost Always)</th>
</tr>
</thead>
<tbody>
<tr>
<td>In one week, how often do you plan to use content that is ecologically relevant? (That is, material that connects to the students’ interests and lives.)</td>
<td>Why say ecologically relevant in the question if we aren’t going to know what that means?</td>
<td>In a given week, how often do you plan to present your content in a way that connects to students' interests and lives?</td>
<td>1 (Almost Never)</td>
<td>2 (Rarely)</td>
</tr>
<tr>
<td>In one week, how often do you plan lessons that involve switching between tasks? (That is, lessons that have several activities or components)</td>
<td>Does this mean a complete change in the focus of the content? Do you mean reading, then writing, then talking? Do all subjects do this, or just classes with labs?</td>
<td>In a given week, how often do you plan lessons that involve shifting focus from one task to another? (For example, moving from one activity to another, moving from individual work to class discussion, switching from using one skill to another, or moving from pencil and paper to computer.)</td>
<td>1 (Almost Never)</td>
<td>2 (Rarely)</td>
</tr>
<tr>
<td>In one week, how often do you plan lessons that involve students talking and interacting with</td>
<td>Are you asking about how noisy the classroom is?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question</td>
<td>Potential Response</td>
<td>Options</td>
<td></td>
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<tr>
<td>-------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>multiple people at the same time? (For example, group discussions, group tasks, or any activities that don’t necessitate a quiet atmosphere)</td>
<td>This question seems like it is the only one that is asking about things we shouldn’t be doing….</td>
<td>multiple people at the same time? (For example, working in groups, giving answers to problems orally, or otherwise doing activities that do not necessitate a quiet atmosphere.) 1 (Almost Never) 2 (Rarely) 3 (Sometimes) 4 (Almost Always)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In one week, how often do you plan lessons that involve students moving throughout the classroom? (For example, to different learning stations, or different seating arrangements.)</td>
<td>In a given week, how often do you plan lessons that involve students moving throughout the classroom? (For example, to different learning stations, different seating arrangements, to gather materials.) 1 (Almost Never) 2 (Rarely) 3 (Sometimes) 4 (Almost Always)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How many students are in your class?</td>
<td>How many students are in your Period 1 Class?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How many of your students receive free or reduced lunch?</td>
<td>In Troy, no one pays for lunch anymore.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How many of your students live in homes that do not feature two parents?</td>
<td>Question is vague. What about if they live with their grandparents? Does this mean biological parents?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How many of your students live in</td>
<td>How many of the students in Period 1 live in households that could be considered single-parent households?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I don’t know, I never call parents.</td>
<td>Difficult is subjective.</td>
<td></td>
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<tr>
<td>Question</td>
<td>Answer</td>
<td></td>
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<td>-------------------------------------------------------------------------</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>homes with guardians that you find it difficult to make contact with?</td>
<td>do you have at least one working phone number that you can use to contact parents/guardians?</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>(For example, phone numbers are disconnected, messages are not returned, etc.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How many of your students live in homes where English is not the primary language used?</td>
<td>How many students in Period 1 live in homes where English is not the primary language spoken?</td>
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<tr>
<td>What is the current class average (in percent) for each of your classes? You can estimate this based on your current gradebook.</td>
<td>Average is not clear. Specify the type of response desired in the question stem.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>What sources of information did you use to create this average? Please explain quantity and type. For example, you might have 3 homework grades, 2 classwork grades, and 1 exam to base your classroom average on.</td>
<td>What sources of information did you use to create the class average for Period 1? Choose all that apply.</td>
<td></td>
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<td></td>
<td>Homework Classwork Tests Quizzes Other</td>
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