Implementing Neurophysiological Research into the Lives of Linguistically and Culturally Diverse High School Students

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Implementing Neurophysiological Research into the Lives of Linguistically and Culturally Diverse High School Students

by

Sabrina Paiz

A culminating thesis submitted to the faculty of Dominican University of California in partial fulfillment of the requirements for the degree of Master of Science in Education

Dominican University of California

San Rafael, CA

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Abstract

Implementing neurophysiological research-based strategies into the lives of culturally-linguistically diverse high school students can better help them strengthen essential neural learning and memory connection in their brain (Griffin, 2017; Choudhury et al., 2008). However, a research-to-practice gap, results in the lack of implementation of university-level research among high school students and families that may aid in their academic success and emotional wellbeing (King et al., 2018; Moir 2018). This study aimed to explore the strategies and challenges of implementing neurophysiological strategies by analyzing a group of twenty-one students of diverse linguistic and cultural backgrounds and three parents in Northern California. A mixed-methods design analyzed qualitative data from student focus groups and parent interviews as well as quantitative data from Likert scale surveys. The data showed that both high school students and parents understand the importance of implementing neurophysiological strategies despite any linguistic or cultural differences. However, barriers to implementation were presented, such as a presumed influential “ghost majority” composed of disinterested individuals as well as a need for increased access and education regarding these strategies. By allowing students to develop personal responsibility over the research topics and strategies as well as encouraging peer-to-peer communication between the students and their families during the implementation and presentation of information, students and parents were enabled to provide solutions to these barriers. With the school fueling connections between students, parents, school staff, and the neurophysiological research, educational institutions can become houses of learning and research implementation for entire communities, despite cultural or linguistic differences.
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Preface

The author of this study, like many other teachers, suffered and survived through the COVID-19 pandemic teaching debacle. An incredible amount of effort went into developing learning moments for her students, and while some students struggled and succeeded alongside the teacher, many were lost to the wayside. The author hopes that this research can be used to help those students and their families if ever a pandemic or learning-from-home model occurs again.
Chapter 1: Introduction

During the COVID-19 pandemic, educators and school officials were unable to provide all students with equitable learning environments that support positive behaviors for neurophysiological growth. Teachers regularly implement positive learning strategies and recommendations with their students while in a classroom, supporting both their neurological and physiological development. Unfortunately, during the learning-from-home model some of these strategies failed to make it home with the students. As a result, teachers were tasked with navigating the aftermath of the development of poor learning behaviors and the subsequent loss of learning upon returning to the classroom. This led the researcher to ask the question: How can the school support students and families in creating effective learning environments outside of the classroom?

Having studied neurophysiology and behavior science in college, the researcher was aware of research-based strategies that aid students’ learning and development. During the pandemic, the researcher’s high school students frequently reported daily actions that did not follow or agree with current research, therefore failing to prepare themselves to learn in their home environment. This failure resulted in a decline in students’ socio-emotional health and academic wellbeing. Bearing witness to this, the researcher became interested in studying the ways in which educational institutions can work to provide students and families with equitable access to current neurophysiological research that can be implemented outside of the classroom environment.

Statement of Purpose

Adolescence is a fundamental time for neurophysiological development and simple and purposeful adjustments to behavior can have significant impacts on the strength and efficiency of
one’s neural brain cells and pathways (Griffin, 2017; Choudhury et al., 2008). Prior studies have investigated the implementation of research into the public education setting and discovered effective strategies for implementing research-based approaches for school staff members that would improve the quality of their curriculum and school policies (Moir, 2018). One notable issue with implementing research is a lack of cultural considerations. It is highly ineffective to try to implement changes without considering the whole individual, to which King et al. (2018) have suggested several strategies for anyone seeking to implement their research into a specific culturally sensitive setting. One mechanism for addressing the culture of a public-school population and reaching out to the families is through the development of family-school partnerships (Hannon & O’Donnell, 2022). These partnerships have proven effective in meeting student academic and mental health needs, although issues surrounding parent-teacher relationships cloud the implementation of these relationships (Costa & Faria, 2017). While past research addresses important aspects of this study, there are clear gaps regarding a main component of the public-school setting: the students. Student interpretations, feelings, and suggestions surrounding neurophysiological research and its implementation into their lives and households are unnoted. Additionally, there is a lack of research on the other challenges that exist as obstacles in the development of a relationship between the school and parents, as well as practices that can be implemented by schools to mitigate these challenges. This is particularly impactful for families of diverse ethnicities and cultures who may not feel connected to the school or university-level research, and whose students would greatly benefit from the implementation of research-based strategies along with their peers. Only by bridging this gap between the school and families can the researcher hope to increase the availability of
neurophysiological research-strategies among families who are unable to acquire this knowledge on their own.

**Overview of the Research Design**

This research was designed around a convergent mixed-method approach with a constructivist and transformative philosophical worldview. The study integrated the lived experiences of twenty-one students of diverse backgrounds and three parents in Northern California. Ethnicities of the students included Hispanic, White Non-Hispanic, Asian, and those of more than one ethnicity and home languages included English, Spanish, and Vietnamese. The research was conducted at a public high school in Northern California. The school is situated in a suburban community, with 65% of the student population being of Latinx descent and 97% qualifying for the free or reduced lunch program. The researcher served as the classroom teacher for all students, all parent participants had students in the researcher’s class and the researcher has lived in the school community for five years.

The students participated in a pre- and post- survey as well as four focus group presentation sessions detailing neurophysiological research-based strategies. Parents participated in a single pre-interview survey and an interview during which they were shown the research strategies and asked about their experiences implementing the strategies with their children.

This study analyzed the following research questions, (1) How do students believe current neurophysiological research can best be implemented in their daily lives to enhance their academic success and learning abilities? (2) How do culturally and linguistically diverse students believe neurophysiological research can best be implemented in their lives? (3) What challenges exist regarding the implementation of neurophysiological research into the lives of high school students? (4) What do students and parents need to effectively implement research-based
strategies into their lives? Both quantitative and qualitative data was collected via two student surveys, one parent survey, four student focus group sessions, and one parent interview.

**Significance of the Study**

The findings of this study allowed the researcher to identify the student perspective and feelings towards neurophysiological research and its implementation in their own lives, what students and parents need from the school to best implement the strategies at home, what implementation challenges exist for both parties, and any notable differences between cultural and linguistic groups. Participants revealed issues regarding the implementation of neurophysiological research that must be addressed as well as possible implementation strategies, including honoring student influence and relying on the school to provide equitable access to research for students and families. A notable issue arose when discussing how one could begin to implement research into the lives of teenagers. Some students spoke of a population of people who they believe would reject and neglect current research-based strategies, including a reference to Hispanic parents rejecting new information. To the students, this phantom-like population became a major barrier for implementation. This perceived “ghost-majority” population of dismissive individuals appeared to negatively impact the students’ perception of how others would react to the implementation of neurophysiological research and recommendations. However, students unanimously agreed on the importance of neurophysiological research-based strategies and stated their desire to implement these strategies in their own lives. This agreement appeared amongst all culturally and linguistically diverse groups. Some students even declared that the implementation of this research should be made mandatory amongst teenagers, by including it as part of their school curriculum. However, students expressed concerns regarding the sensitive nature of some environments and individual
feelings. While the use of the strategies was deemed necessary, student opinions deviated when discussing the ideal location for introduction of the research. Some students see school as a place of learning and home as a place for relaxation; however, others feel less able to implement changes in their school lives due to the large amount of work they are already tasked with completing. Therefore, when asking individuals to adopt new life strategies, researchers would need to consider the possibility of implementation in both the school and home settings while allowing for flexibility. Additionally, participants noted that some populations may begin to feel negatively about themselves or the research if it is contradictory to their current behaviors. Therefore, researchers would need to consider how the research is presented during the implementation process and to whom they are presenting to.

Solutions for the issues mentioned above included placing the responsibility of implementation on the shoulders of the students and using the school as the access point for neurophysiological research. Students can become the bridge between the school and families, therefore helping to build partnerships and relationships between the two. Students stated that they want to be responsible and have choice in deciding which strategies they learn and implement, and parents echo this sentiment. Placing the students in charge of the disbursement of research helps foster peer-to-peer communication and mitigates any negative perspectives, misunderstandings, or cultural and linguistic differences that may exist between parents and school officials when it comes to the recommended neurophysiological strategies. While students want to take the lead when handling the strategies, both students and parents expressed that they need assistance in accessing and clarifying university-level research. The school can meet these needs for all families, provide equitable access to the research-strategies using appropriately translated, easy to read documents.
Research Implications

The findings of this research support the use of both families and teachers in aiding student acquisition of research, as well as the importance of school influence in implementing neurophysiological research-based strategies outside of the classroom. For successful implementation, teachers would need to provide their classes with ample time to explore neurophysiological strategies and allow students to take personal responsibility over which strategies they plan to use. This responsibility could take form through mandatory units of study as well as home presentations. As a result, families would also need to actively participate in the attainment of information and create spaces for student engagement.

Prior to family engagement at home, the school would need to facilitate the exposure of families to the research and subsequent research strategies by hosting regular, informal meetings and programs. The school administration would need to make these informal meetings a priority and establish flexible meeting times or employ the use of video conferencing technology to best adapt to busy family schedules. A relaxed atmosphere would allow for a better chance at building fundamental partnerships between families and neurological research, therefore bridging the gap between research and practice for families that may be unfamiliar with research or have alternative or contradictory lifestyle habits. This would allow for access and clarity for all families in the community.

To help execute these meetings, school districts can begin to adopt policies that provide the time and finances necessary to host both informal seminars, such as the ones mentioned above, as well as formal training opportunities for families. Formal events would allow all parents the opportunity to learn how to best support their students’ use of neurophysiological strategies outside of the classroom; this is especially important for families and students with
limited knowledge of how to obtain and read current research materials. During these meetings, families would benefit from receiving easy to read checklists, appropriately translated research topics, and exposure to student research presentations and feedback. These research implications can further efforts in implementing neurophysiological research into the daily lives of high school students.
Chapter 2: Literature Review

Neurophysiological research aimed at educational success is failing to make it into the hands of the target populations, such as students and parents (Soicher et al., 2020). Yet, this research is especially important during the years of adolescence, when the human body is experiencing significant neurophysiological developments and neural reorganization (Griffin, 2017). Implementation Science further suggests that participants feel more connected to research that is directly related to their circumstances and culture, which encourages them to apply it to their lives. Failure to account for cultural differences and influences when performing research can lead to low-reliability and low-adoption rates (King et al., 2018). Smith et al. (2020) argue that the inclusion of teachers, students, parents, and school administrators during the implementation process and the development of family-school partnerships increases the likelihood of research implementation. This literature review will outline research on adolescent neurological development, the history, function, and practice of implementation science, and, finally, the value of the dynamics of cultivating school to family partnerships with relevant research on participatory action research and cultural considerations.

Adolescent Neurological Development and Research

The period of adolescent development is a critical time for both growth and deterioration of the neural connections of the brain (Griffin, 2017). During this period, the brain has developed the majority of its neurons, or brain cells, and focuses on strengthening the connections that exist in its five main regions. Strengthening can include both the growth and development of certain areas of the brain as well as the pruning of areas that are not frequently utilized. Any decrease in neural density would promote greater efficiency for the future adult brain (Choudhury et al.,
2008). Whether or not growth or deterioration occurs depends on the experiences and choices of
the individual (Griffin, 2017).

**Neuroanatomical Background and the Teenage Brain**

The brain is composed of five main regions (See Figure 1), each responsible for specific
functions (See Figure 2). The regions include the frontal lobe which controls language, smell,
critical thinking, planning, attention, and some motor skills. The parietal lobe across the top and
back half of the head is responsible for basic physiological sensors for temperature, pain,
pressure, and touch. The temporal lobe, at the base of the brain, houses one’s auditory and
complex visual processing centers and manages the memory regions. The occipital lobe, which
sits at and projects out of the back of the brain, regulates basic visual processing. Finally, the
cerebellum, nestled under the occipital lobe and connected to the top of the spine, helps
coordinate voluntary movements (Queensland Brain Institute, 2018). Understanding the unique
functions of each region can help one analyze developmental patterns and concerns during
adolescent development. If certain brain regions are underdeveloped, then that can result in
specific actions or processing difficulties of the teenage individual. Underdevelopment can be
indicated by a lack of gray or white matter in the brain.

As an individual ages, their brain typically increases its amount of white and gray matter.
Gray matter makes up most of the brain’s composition and is responsible for processing
information. White matter regions link the larger gray matter sections, acting as communication
pathways. Both types of matter are made up of neurons (See Figure 3), which transmit
information from the outside world to our brain as electrical signals, which then allow for
physical responses and mental responses (Queensland Brain Institute, 2018). During
adolescence, the brain works to further develop these neurons with the goal of producing deeper and stronger connections between the brain regions.

Teenage brains are primed for neuronal development on both ends of a neuron (Griffin, 2017). The axon’s ends grow additional myelin sheaths, insulating the neuron and providing the white color for white matter in the brain. The dendritic ends increase in branch numbers, furthering their ability to reach and receive transmissions from other neurons (Griffin, 2017). These developments increase the speed of electrical message transmissions within the brain.

Synaptic regions are also under development during this period. These regions lie between the dendritic ends of one neuron and the axon receptor ends of another (Griffin, 2017). It is in these spaces that neurotransmitters, chemical messengers responsible for specific actions within the body - such as serotonin, dopamine, and acetylcholine - are passed along (Hyman, 2005).

The release of neurotransmitters can be manipulated based on a human's environment and choices as they age, especially in the teenage years (Griffin, 2017). Synaptic regions (See Figure 4) used regularly are enhanced over time while those that are rarely or never used slowly diminish. This shrinks the unused gray matter of the brain and builds an increasingly efficient neural network. What is diminished or grown is influenced by experience (Griffin, 2017).
Figure 2
General Functions of the Brain Sections.

Figure 3
A Nerve Cell from the Central Nervous System

![Neuron Diagram](https://commons.wikimedia.org/wiki/File:Neuron.svg)

*Note.* An image of a typical nerve cell found in the central nervous system (brain and brainstem).

The dendrites of a neuron receive information which then travels through its axon and then is transmitted to another neuron. Myelin sheaths are developed around the axon of a neuron to enhance transmission speeds. *Wikimedia Foundation*

Note. Synaptic regions lie between the axon terminals of one neuron and the dendrites of another neuron. Neurotransmitters are stored in the axon terminals and released based on electrical signals received from the sending neuron. The neurotransmitters move through the synapse space to the receptor proteins on the dendrites and cause the second neuron to have a cellular response. Any unused neurotransmitters are either broken down or transported back into the sending neuron. From University of Maryland School of Medicine. (n.d.). Synapses and Circuits. Research Focus Groups. https://lifesciences.umaryland.edu/neuroscience/Research-Focus-Groups/Synapses--Circuits/

Neurophysiological Research

Knowing the importance of the adolescence years on the brain would drive educators and adolescent health professionals to implement current neurophysiological research into their daily lives. Teenage brain development is highly influenced by the choices made during one’s early years, and therefore should be considered a top priority when discussing their health and
wellbeing (Griffin, 2017). Current neurophysiological research presents multiple means of providing teenagers with research-based strategies for brain growth and ways to address major issues they may suffer from, including sleep deprivation and attention problems.

**Exercise and Environmental Enrichment Research.** Research shows that the brain can be influenced to stimulate white matter growth through chronic exercise and environmental enrichment, especially during the malleable teenage years (Park et al., 2018). For instance, Park et al. (2018) studied the effect of low-intensity, chronic exercise on animal patients experiencing lower cognitive function due to a specific chemotherapy drug. Rats subjected to routine, low-intensity exercise maintained their cognitive and mitochondrial functioning and lower levels of neuroplastic impairment (Park et al., 2018). This means that their brain cells experienced no deterioration and that their brain was able to grow and heal itself, even in a destructive environment. Ang and Gomez-Pinilla (2007) analyzed the physiological mechanism behind the neurological benefits of exercise. Whether voluntary or mandatory, exercise is associated with the release of neurotrophins, chemicals that influence the development of neurons, such as “nerve growth factor (NGF) and brain derived nerve factor (BDNF)” (Ang & Gomez-Pinilla, 2007, p. 2564). These chemicals prevent the degradation of neurons and support their overall survival rate and growth. Furthering this research, Clemson et al. (2018) showed how physical activity can increase the number of newborn neurons in specific areas of the brain such as the hippocampus. This region has been related to spatial memory, pattern recognition, and the transition of short-term memory into long-term memory. This research presents a clear mechanism for brain development and healing, where low-intensity exercise is seen to lead to brain growth, memory processing, pattern recognition, and new neuron development. All these benefits would suit and empower teenagers as they move through high school.
Environmental enrichment (EE) is a term used to describe the making of a novel environment for mice that enhances their overall living habitat and brain development. This includes novel elements like toys and play structures introduced daily, thus providing the mice with a new environment with which to explore and adapt. Current literature on EE suggests correlations between both mice and humans. When humans are exposed to novel virtual or real environments to explore, the hippocampal regions of the brain develop. This exposure leads to an increase in the amount of matter, specifically gray matter, which is primarily responsible for excitatory nerve functioning, otherwise known as synaptic firing (Clemenson et al., 2015). Therefore, more gray matter leads to higher brain functioning and processing rates, and in the hippocampal region, this means a higher memory capacity. Introducing students to new environments from an early age, whether they be real or virtual, will promote significant growth in the regions we ask them to rely on in the future. Teens who have not had these experiences may be at a disadvantage to their peers when it comes to overall neural processing and memory development.

This research indicates that adolescence is a time where teens are presented with opportunities for brain growth and development when completing simple tasks, such as exercise and exploring new real or virtual environments. The science behind exercise and exploring new environments should be brought to the forefront of these teenagers’ lives, allowing them the access to important information about current and future brain maturation.

**Light Exposure Research.** Light exposure is a primary area of study when discussing neurological influences on the teenage brain due to its effects on sleep patterns and attention (Studer et al., 2019). In the age of social media and smartphones, sleep and attention are major concerns, even thought to be encouraging of the development of ADHD (Zimlich, 2018). Human
brains contain a circadian pacemaker within the suprachiasmatic nuclei (SCN) section which sets the stage for sleep and wake cycles (Maywood et al., 2021). Light exposure activates this section of the brain and manipulates this circadian rhythm either through enhancement or disruption (Studer et al., 2019). Current neurophysiological research addresses the positive effects of light exposure by looking at high intensity red- and blue-light and light at specific color correlated temperatures (CCT) respectively.

Studer et al. (2019) found that adolescent sleep patterns are affected by red and blue light exposure one hour prior to bedtime. If exposed to red light, they can get to sleep faster and experience lower amounts of movements during their sleep cycles. Zhao et al. (2012) corroborates these findings, identifying red-light as a main source for improved sleep quality and heightened endurance levels. In contrast, blue light leads to increased sleep disruptions from the short wavelengths emitted from blue light sources, such as smartphone and monitor screens (Hale et al., 2019).

Similarly, Wen et al. (2021) found that color-correlated temperature (CCT) lighting has effects on adolescent sleep patterns and energy levels. When experiencing low CCT light (2000 Kelvin) from light-emitting diode (LED) lamps as compared to fluorescent light (high CCT) an hour before bedtime, adolescents showed improvement in sleep quality and reductions in next-morning sleepiness and fatigue. This suggests that low-intervention experiences can contribute to neurophysiological benefits in teenagers.

Light exposure at inappropriate times, exposure to daylight radiation in the evening, ineffective exposure to light, early mornings without the sun rising, and exposure to light of artificial creation – such as blue light from screens - can all lead to disruptions within one’s...
cycle. This leads to upset sleep patterns, daytime drowsiness, and lower attention capabilities (Chellappa et. al., 2011; Wen et al., 2021).

These two sections of neurological research highlight simple, minimal tasks that hold extreme relevance to bettering the teenage neurological system. These findings represent low-effort, high-reward adaptations that can be made in a teenager’s life outside of school, which would have the possibility of enhancing their ability to perform academically. Adhering to recommendations for low-intensity exercise routines, the exploration of new environments, and specific light exposure at specific times can help a teenager support their own brain growth, regulate their sleep cycles, and better their attention capabilities.

**Implementation Science**

The implementation science (IS) field studies the researcher-strategies required to deliver academic research to its intended realms of application. For teenagers, this realm would include their personal lives both in and out of school. Current implementation researchers outline the need for this field of research.

For example, Soicher et al. (2020) discovered that research behind cognitive development and learning fails to make it into the classroom setting and the lives of students, and instead, old, ineffective practices continue to dominate traditional education systems. They realized that the field of IS addresses the existence of this “research-to-practice gap” (Soicher et al., 2020) between research and application in education and can be the means of analyzing the relationship between “institutional, [instructional], and student characteristics” (Soicher et al., 2020).

Moir (2018) refers to IS as the process by which one analyzes the core components required to “promote authentic adoption” (p. 1) of the research in question. These components include the general motivation of the adopters in question, the availability of training and
coaching, the reflective capabilities of the adopters, the available time and resources for implementation, the investment required to implement such research, and finally, how the research aligns with the socio-emotional and political aspirations of the business. Authentic research requires these six components during implementation if the study hopes to make it further than development. Green (2008) has described the current gap between research and practice as a funnel, with only a fraction of the research produced in an academic setting making it to the population in question. Green (2008) also argues that most research is performed in a controlled, academic setting away from potential practitioners, which in turn lessens the practicality of the research itself. Researchers must consider the uniqueness of the population that is meant to use the data. Concerning high school students, the application of research would benefit from considering aspects of a teenager’s life such as the school environment, the adults in their lives, their unique perspectives, and their interactions with other teenagers and school officials.

**History of Implementation Science**

IS was first introduced into the world of medical and public healthcare. Balas and Boren (2000) found that certain highly effective medical procedures and processes took an average of 15.5 years for the research to make it as basic practices within hospitals and clinics if no interventions were taken. Considering the rapid growth within the field of healthcare research, this proves extremely problematic for doctors and nurses who want to deliver current and optimal procedures to their patients. This is no different for the public health field, which identified the number of years between research completion and actual practice as 17 years, with only 14% of that research being labeled as best practices in the end (Green, 2008). Consequently, the worlds of clinical- and public- health have adopted IS theoretical frameworks to address the
core components behind the implementation of research and to “systematically study the factors” (Soicher et al., 2020, p. 2) that influences the successful implementation of such research in the field. In recent years, Oermann et al. (2022) looked at the use of IS frameworks when advancing the education of professional nursing students. They identified the clear needs for using IS frameworks and theories in an educational setting to help the educators best supply their students with the research, dispense the research, and then analyze the effectiveness of the implementation using student feedback and test scores (Oermann et al., 2022), thus determining exactly how IS can aid educators when they need to supply their students with new studies and methods. This history illustrates the evidence surrounding the use and practicality of IS strategies in the field of secondary education. These revelations revealed a need for further research on the application of IS strategies used to administer cognitive learning data amongst high school students just like it had been implemented in higher education (Soicher et al., 2020).

Implementation Science, Education, and Cultural Relevancy

The art of using IS in the world of public education is new and its use has allowed for the development of implementation strategies (Lyon et al., 2018). Moir (2018) focused on how IS could be useful for staff members working at schools. They found that IS produced “universal [strategies]” that can create “sustainable positive differences” in the school environment through staff members. Implementing IS frameworks into the “design and evaluation of … school [programmes]” (p. 7) would increase their success rates. Considering the educational sector, IS frameworks recommend specific strategies such as (1) “[ensuring] staff readiness” and understanding of the material, (2) having an accurate method for measuring the success of the implementation, (3) raising awareness of the research amongst those involved, and (4) carefully considering past implementation strategies, so as to not demotivate staff with the reintroduction
of past implementation attempts that may have been unsuccessful (Moir, 2018). If an organization can understand the “fundamentals” of IS, they would be able to apply new strategies amongst their staff and “bring about positive change” to their school community (Moir, 2018). This proved that the field of education can greatly benefit from the use of IS strategies in education if professionals are given the opportunities to learn and absorb the research.

King et al. (2018) and Moir (2018) analyzed the need for effective strategies that considered the culture of the participants in question. Currently, there is a lack of culturally relevant research and culturally considerate research application in the field of educational psychology, the field responsible for understanding the relationship between the educational system and those involved in the system: students, teachers, staff, and parents (Moir, 2018). A majority of research focuses on actions and behaviors without analyzing the culture of the study participants (King et al., 2018). A main goal of an educational system, then, would be to bridge this gap and allow current research to become applicable to and reach the individuals involved using culturally relevant education strategies (Brown et al., 2019).

Culture is traditionally defined as subjective, referring to the individual’s “social norms, beliefs, values, and traditions” retrieved from the larger population they live within (King et al., 2018, p. 1032; Triandis, 1972). Moir (2018) found that individuals feel more connected to research if it addresses their social, political, and cultural backgrounds. This idea is an extension of the ecological systems theory (Bronfenbrenner, 1979). New for its time, this theory addresses the whole person, seeing individuals as “developing” alongside their environment and vice versa. To understand an individual, one would need to consider the direct developmental leverage their environment continues to have upon them as they encounter “political, social, and cultural
influences” (Bronfenbrenner, 1979; Moir, 2018, pg. 2). These considerations are especially important within the system of education and with high school students, where students, parents, and staff members bring their unique cultures onto the same campus every day and require specific considerations for anyone attempting to analyze their behaviors (Brown et al., 2019). Addressing the cultural and social needs of high school students in the educational system would provide significance and value for those involved and make the material relevant for the populations it is designed for, such as high school students with diverse linguistic and cultural backgrounds (Moir, 2018).

Strategies exist to help a researcher consider the cultural background of the participants. King et al. (2018) suggests a strategy where researchers “cultivate [their] cultural imagination” (p. 1031) when studying and observing individuals of a different culture. This change in perspective allows the researchers to bridge the cultural gap between themselves and their target populations. Their research must consider how “human behavior [is] shaped by cultural forces” (King et al., 2018, p. 1034). This means that behavior and actions cannot truly be studied without considering the cultural rationales, motives, or philosophies of the target populations. Additionally, King et al. (2018) provides additional recommendations that researchers can apply to the high school student that would help them properly and ethically consider the culture of their participants: linguistic equivalence is used to ensure that the vocabulary used during the study holds the same meaning across the cultures involved; using data collection tools such as behavioral observations and implicit questioning, using questions that target elusive memory center of the brain for indirect measurements of “social cognitive constructs, including attitudes, stereotypes, identities, and self-esteem” as compared to self-reports which can generate inaccurate data points (Greenwald & Lai, 2020, p. 421; King et al., 2018); using multilevel
structures of data collection to analyze research conclusions across multiple ethnic groups and not just across multiple individuals; and using both “etic and emic approaches” (King et al., 2018, p. 1035) to research design, placing emphasis on both the researcher’s culture and point of views as they attempt to implement their own theories and perspectives into the lives of individuals with a different culture to collect data from the perspective of another culture. This model allows the researcher to examine theories beyond their own existence (King et al., 2018).

**Participatory Action Research Pedagogy**

One method used to aggregate these strategies and allow a researcher to incorporate culture when implementing research is the use of “participatory action research” (PAR) (Green, 2008, p. i20) to derive both direct and implicit perspectives from the individuals themselves. PAR can allow participants to actively engage in the research in a variety of methods from the initial formation of the research design to digesting and discussing the implication of the research findings (Whyte et al., 1989). Whyte et al. (1989) argues that, traditionally, researchers have distanced themselves from the world that they hope to explore, and that this ineffective method would only generate low levels of understanding. In the field of education, PAR techniques have allowed for researchers to focus on the student participants and showed benefits such as the rise in youth self-efficacy and the genesis of the teacher-as-facilitator role which places emphasis on student voices in the classroom (Phillips et al., 2010).

PAR strategies agree with the recommendations outlined above when wanting to implement research among students with multi-cultural and linguistic backgrounds. By focusing on participant voices, the researcher ensures that they are testing for linguistic equivalency throughout the data collection process. One-on-one conversations allow the participants to ask questions and engage in the material in a direct way. These open conversations allow the
researcher to document behaviors and real-time interactions that could reveal any implicit attitude towards the study (King et al., 2018). It also provides multilevel means of data collection with the participant remaining at the forefront of the study since the individuals naturally answer and then continually evaluate their responses based on their culture as the research progresses (Green, 2008). This would mean that cultural and linguistic diversity is naturally intertwined into the research itself without the researcher having to generate moments or questions that focus on language or culture. Therefore, the researcher is free to approach their study with an etic mindset, revealing their own culture appreciations, as well as an emic mindset and closely consider the participants culture when analyzing findings.

Since research on individuals cannot exist without culture and individuals cannot be solely defined by their culture, providing the participants with a research-like role in the study ensures that their cultural perspectives will be considered at all moments, and the data will not be skewed by the researcher’s own cultural perspectives.

**Family-School Partnerships**

One method for bridging the gap between research and practice and addressing the culture of families is through the development of family-school partnerships (FSP). These partnerships that form between teachers, school officials, and parents allow the school to have a direct impact on its students both outside and inside of the school environment, resulting in increases in academic performances and mental wellbeing while simultaneously empowering parents to support their children when the school is not around (Hannon & O’Donnell, 2022). FSP interventions bridge the gap between the home and the school using techniques that allow both parties to collectively support the students using “collaboration, cooperation, consistent messaging, planned and coordinated strategies, … and information sharing” (Smith et al., 2020,
p. 513); just like with implementation science practices, these partnerships are grounded in the ecological systems theory which states that a child’s development is heavily influenced by experiences within their cultural, political, and social environments (Smith et al., 2020; Moir 2018). Therefore, this partnership is necessary if a researcher hopes to employ IS techniques to account for cultural and linguistic differences when attempting to implement current neurophysiological research into the lives of high school students outside of school (Smith et al., 2020).

**Cultural Considerations with Family-School Partnerships**

Culture can impact the development of FSPs. These partnerships are proven to aid students in their academic performances and emotional wellbeing even when traditional academic supports, such as high socio-economic status, are unable to, and misconceptions about teacher and parent roles arise (Smith et al., 2020; Gustafsson & Hansen, 2018; Smith et al., 2008).

Immigrant or minority status impacts the education system and a multitude of new cultures and languages that appear can affect the relationship between schools and families (Antony-Newman, 2019). In Swedish schools, students with native Swedish backgrounds enjoyed small correlations between high socio-economic status (SES) and student academic performance, while students with foreign backgrounds saw no benefit in academic achievement despite SES (Gustafsson & Hansen, 2018). It is the belief of the researchers that the parents from foreign backgrounds were unable to bridge the language and cultural barriers associated with the Swedish academic work despite their level of education, and therefore were unable to assist their children with the work (Gustafsson & Hansen, 2018). Hispanic parents in America experience language barriers and misconceptions about teacher and parent roles, which hinder their ability to
communicate and develop relationships with school officials (Smith et al., 2008). These parents saw their role in the education system as homework helpers and behavioral regulators, whose jobs would start and end in the home and not when the child was in school. Parents saw the teacher’s role as one that cultivates skills in both academic and behavioral facets, meaning that when a student does not perform to expectations, it is the teacher’s job to illustrate correct behaviors (Smith et al., 2008). These misconceptions that the parent should not intervene on behavior and academic wellbeing in the school setting can be misinterpreted by school staff as parental apathy towards their children’s education (Anastasiou & Papagianni, 2020). This breakdown in communication can be attributed to the facts that the majority of Hispanic parents are afraid to contact the teacher or school administrators because they either see teachers and administrators as distant and unapproachable, or they themselves cannot speak English and would need to use their child as an interpreter, which could be embarrassing or lead to the communication of inaccurate information (Smith et al., 2008). Families from a multitude of immigrant backgrounds have found it difficult to integrate their culture and expectations into the native school system, with some backgrounds finding it easier and others more difficult based on the perceived race and class of the immigrant populations and stereotypes held by the native populations (Antony-Newman, 2019). These findings illustrate a hurdle faced by many culturally and linguistically diverse families around the globe who wish to support their children in school but find themselves unable to access the curriculum.

Different cultures approach family-school relationships and roles independently, and these variances need to be addressed. It is imperative that schools help to increase effective parental involvement in the education system, which shows positive effects on student success and academic achievement (Rivera & Li, 2019; Willemse et al., 2018). This is where we can turn
back to the development of FSPs. When implementing these partnerships, researchers failed to find any discrepancies in the data between students of different ethnic backgrounds, meaning that these interventions apply to all students despite cultural differences (Smith et. al., 2020). This provides researchers with an implementation strategy proven effective with students of all backgrounds.

**Current Perspectives on Family-School Partnerships in Secondary Education**

Past research suggests that the majority of individuals involved in the educational process have the desire to collaborate with one another but find significant barriers to the process (Costa & Faria, 2017; Anastasiou & Papagianni, 2020; Willemse et al., 2018). These barriers can be witnessed from the parent, teacher, and school administrator perspectives.

**Barriers that Parents Experience.** Parental perspectives on barriers to FSP include parental outlooks on roles and responsibilities and their general relationship with the school system (Costa & Faria, 2017). Parents see their role as focused around establishing and enforcing rules outside of the classroom. They view this job as “the hardest work of their lives” and reference their lack of time as the major reason for any parenting struggles (Costa & Faria, 2017, p. 31; Smith et al., 2008). This is especially true for parents who endured pandemic-age learning and had difficulties related to limited resources, high-stress situations, financial struggles, and issues managing the time required to help their children learn at home (Ribeiro et al., 2021). Parents also noted that the relationship between themselves and the school lacks real communication. They hope for teachers to bear the role as mediators who encourage more parental involvement (Costa & Faria, 2017). Unfortunately, parents believe that the majority of communication occurs under negative circumstances, instead of receiving positive feedback about their children (Costa & Faria, 2017). This negative-behavior focused approach can lead
parents to feel as if their homelife is judged by teachers and school officials, with some parents even finding it “horrible” that teachers would ask about personal predicaments to understand student behavioral issues (Hannon & O’Donnell, 2022, p. 245). These sentiments lead both parents and FSP researchers to believe that teachers require training on how to involve parents in their child’s education (Anastasiou & Papagianni, 2020; Willemse et al., 2018).

**Challenges that Teachers Experience.** In contrast to the parental perspectives, teachers face challenges in developing effective FSPs, including their perspectives on their roles and responsibilities, a lack of professional development, and perceived parental attitudes towards both teachers and the education system (Anastasiou & Papagianni, 2020; Willemse et al., 2018). High volume workloads and daily responsibilities prevent teachers from acting as the sole mediators between the school and families. The high workloads prevent teachers from reaching outside of their classroom and drive their need for autonomy. Overwhelmed teachers, therefore, push back against outside influences that appear to only add to the mounting pressures teachers face, such as suggestions or recommendations made by parents who want to be involved in their child’s education (Anastasiou & Papagianni, 2020). This negative view towards certain types of parental involvement comes from a lack of professional development (PD) opportunities surrounding teacher-parent relationship building (Willemse et al., 2018; Hannon & O’Donnell, 2022). Teachers are not receiving the necessary support they require to develop the communication and socio-emotional skills they need to approach all types of families and communicate during a variety of situations (Hannon & O’Donnell, 2022). This lack of communication and thus understanding can lead teachers to perceive some parental actions or inaction as negligent and indifferent (Anastasiou & Papagianni, 2020; Hannon & O’Donnell, 2022). Teachers cite these negative parental attitudes as a main reason for struggling
relationships with families, leading to increased hesitation for any proactive communications
(Anastasiou & Papagianni, 2020; Willemse et al., 2018).

**Increasing Family-School Partnership: Possible Solutions**

This then begs the question: How do we fix the bonds between families and the school? Prior research suggests that planned meetings, parent- and teacher- training, and increased administrative leadership can lead to positive effects on the development of FSPs (Costa & Faria, 2017; Willemse et al., 2018; Hannon & O’Donnell, 2022). Parents, teachers, and school administrators all agree that thoughtful and planned, informal and formal events can help develop relationships between families and school faculty (Costa & Faria, 2017). More informal events hosted by the school in addition to existing events such as “theatres, sport activities with parents, celebrating special days such as mother’s/father’s days, [and school dances]” would allow for the development of a positive and relaxed climate, where families can begin to bond with the school and their children’s educators (Costa & Faria, 2017, p. 6). Formal meetings, such as parent-teacher conferences and back-to-school nights, that focus on students' successes increase the likelihood of a positive relationship (Anastasiou & Papagianni, 2020). Parents sometimes fear judgment from teachers when it comes to their student’s misbehaviors, making them less likely to engage positively with teachers. This in turn can cause teachers to “[adopt] a protective stance” against parental responses and impede their ability to connect with families (Hannon & O’Donnell, 2022, p.249). However, when student success is highlighted in formal meetings above misbehaviors, parents feel more ownership and are more committed to supporting the school’s mission and begin to show their sense of responsibility for their child’s academic and behavioral success (Anastasiou & Papagianni, 2020). To conduct these informal and formal meetings effectively, research recommends that both parents and teachers undergo
role specific training (Anastasiou & Papagianni, 2020; Hannon & O’Donnell, 2022; Willemse et al., 2018). Parents need to be trained in their role of support with their students and in communication with school staff, while teachers require training with parental involvement and communication tactics (Anastasiou & Papagianni, 2020; Brinckerhoff & Vincent, 1986).

Fernández Alonso et al. (2017) argue that the responsibility for establishing the culture, practice, and training for these relationship building activities lies in the hands of the administrators. and should be encouraged throughout grades K-12. It is known that certain parental involvement patterns can diminish academic results and overall student achievement when the parents take an overly controlling stance towards their secondary student.

This effect, however, can be mitigated by the parental training and specific roles given to all in the education system. Allowing parents and teachers to develop relationships and skills increases and develops the “three essential conditions [known as] capability, opportunity, and motivation” (Michie et al., 2011, p. 1) needed to convince individuals to make significant behavioral changes. These changes then translate into building and solidifying family-school partnerships.

**Conclusion**

The majority of neurophysiological research strategies fail to make it into the hands of those that need them most: teenagers. The period of adolescent development is one of high neurological expansion and reinforcement and should be considered an important stage of neurophysiological research implementation (Griffin, 2017). Simple tasks such as increased low-intensity exercise and light manipulation can create large impacts on adolescent attention and sleep deficiencies (Clemenson et al., 2015; Clemenson et al., 2018; Park et al., 2018). Implementation science lends its perspective on the administration of research into the lives of
individuals, suggesting cultural considerations and participant engagement as main components for effective implementation (Moir, 2018; King et al., 2018). It is important for all members of the educational system: parents, teachers, school officials, and especially secondary students to be involved in the implementation process (Hannon & O’Donnell, 2022). Despite the growing field of implementation science, there is little research analyzing the student voice and perspective on implementing research-based strategies in their lives, and exactly what challenges and necessities exist for both students and parents of culturally and linguistically diverse backgrounds. This study seeks to understand the implementation science of integrating neurophysiological research into the daily lives of culturally-linguistically diverse high school students, using participatory action research techniques that will invite unique participant perspectives, insights, and plan for change meant to better provide an equitable attainment and application of neurophysiological research-based strategies.
Chapter 3: Methods

Adolescence is a critical period of neurological and physiological development but research on neuronal development and healing is failing to make it into the daily lives of adolescent students (Soicher et al., 2020). The field of IS suggests that research can make it into the hands of those it addresses if the participants themselves are involved in the process (King et al., 2018). This closely relates to the theory of participatory action research, where participants directly influence the research process and conclusions along with the researchers (Whyte et al., 1989; Phillips et al., 2010). This places power in the hands of those who would be affected by the research, leading to relatable and responsive outcomes (Green, 2008). Smith et al. (2020) suggests that both the school and the family need to form a partnership based in communication and collaboration to best support the student. This study aims to analyze the student perspective about the implementation of current neurophysiological research into their daily lives.

Research Questions

This study examines how neurological research could be implemented into the lives of adolescent students through the eyes of the student’s themselves and their parents. Prior research focuses on administrator and teacher perspectives on parents and students and the parent perspectives on teachers and school officials. However, it fails to look at the student perspective on research implementation and the parental perspectives on what their students need to be successful during implementation. It appears that past research ultimately left out the student part of the equation.

This research will account for that population and dive into their unique perspectives while staying mindful of cultural and linguistic backgrounds. The central research questions include the following:
1. How do students believe current neurophysiological research can best be implemented in their daily lives to enhance their academic success and learning abilities?

2. How do culturally and linguistically diverse students believe neurophysiological research can best be implemented in their lives?

3. What challenges exist regarding the implementation of neurophysiological research into the lives of high school students?

4. What do students and parents need in order to effectively implement research-based strategies into their lives?

**Description and Rationale for Research Approach**

In generating research on the evaluation of surveys, interviews, and focus groups sessions hosted at a high school, the researcher conducted a mixed methods study with transformative and constructivist worldviews. A mixed methods approach was used to create a more complete understanding of the method required to implement neurophysiological research into the daily lives of high school students with culturally and linguistically diverse backgrounds and analyze both the processes and outcomes of presented research and focus groups. This approach integrates both qualitative and quantitative data (Creswell & Creswell, 2018).

For the study, qualitative data was collected in the form of parent interviews and student focus groups, while quantitative data was collected in the form of surveys. A qualitative approach was necessary for this study because it allowed the participants to digest the research presented, derive their own meaning behind the research, and come up with solutions to implementation. The researcher approached the focus groups with a narrative mindset, asking the
participants to provide personal stories where they related the neurophysiological research to their past and current lives (Creswell & Creswell, 2018).

A quantitative approach allowed the researcher to gather background information on the participants and identify responses to baseline questions. The questions were presented as a Likert scale survey, with the participants providing their ratings for each statement using a predetermined scale of one to four with one being Not Ever/No and four being Totally Agree/Always. The survey results allowed the researcher to analyze trends in the data and create a more general interpretation of their attitudes and opinions (Creswell & Creswell, 2018).

A constructivist worldview aims to explore the meaning behind life’s occurrences and promotes the generation of subjective meaning by the individuals (Creswell & Creswell, 2018). This research allowed for the participants to engage with the neurological data presented to them and develop their own meaning behind the purpose of such knowledge and how it can be implemented into their daily lives, or if it should be implemented at all.

A transformative worldview focuses on change and action. Researchers with this approach believe that their study needs to be intertwined with the social, cultural, and political struggles of the marginalized individuals they are studying (Creswell & Creswell, 2018). Taking a transformative approach to research means going beyond the writing and quantitative data and aims to inspire change using qualitative research, such as that of participatory action (Creswell & Creswell, 2018). Participatory action research allows the subjects of the study to have a voice and representation, making the research relevant and influential to the community it is meant to serve. It also humanizes the participants of the research study, focusing on the individuals rather than the researchers (Paris & Winn, 2013).
Research Design

This research was designed to determine an effective approach to implementing current research into the daily lives of culturally and linguistically diverse high school students. All the individuals are referred to with pseudonyms throughout this thesis to protect their identities. The high school itself will be referred to as “Eureka High School.”

Research Site and Entry into the Field

The research site is a high school in Northern California where the researcher is currently a science teacher serving grades nine through twelve. Consent was given by the principal to conduct research, focus groups, and surveys with the students during class time periods. Consent was also given to conduct research, interviews, and surveys with the parents of certain students after school hours. This school is located near the city downtown, local transit center, and a small mall with several businesses and restaurants. There are 1,379 students attending the school; 557 students are English Language Learners, and 1,341 students qualify for free or reduced lunch prices (Ed Data, 2021).

Participants

Ninth through twelfth grade students at Eureka High School were recruited for participation in this study in the researcher’s Physics of the Universe course which has been taught since August 2019. During the 2021/2022 school year, the research conducted four focus group sessions and issued two surveys with the Physics of the Universe students during the Spring semester. The students in this study were of diverse ethnic origins. A total of 21 students participated in the study. Four of the participants were of more than one ethnicity, four were White, two were Asian, and eleven of the students were of Hispanic origin. Home languages for the students included eight as English-only, eleven as Spanish, and two as Vietnamese.
Three of the students were classified as English Language Learners, one of the students was enrolled in a special education plan, and nine of the students are redesignated English Language Learners. None of the Hispanic students and only one of the Asian students had parents who attained a four-year college degree. All the White students had at least one parent attend or complete a four-year college or university program.

Three parents of the researcher’s ninth through twelfth grade students at Eureka High School were recruited for this study and all were of a white ethnicity.

**Sampling Procedure**

An invitation to participate in the focus groups and surveys was announced during a class period for all three classes. Students were told that all students were to participate in the focus group activities since they will occur during class time, but that their data would not be used if they or their parents did not want to complete the consent forms.

An invitation to participate in the interviews and surveys was announced to parents at the beginning of the study using email communications. These communications also included information on what the student experience would be during the study.

**Methods**

The qualitative data, obtained through analytic memos, interviews, and written focus group answers, and the quantitative data, collected via Likert scale surveys, were both centered around the lived experiences of each participant in relation to how research should or currently does affect their daily lives and the lives of others. The qualitative data allowed the participants to interpret and identify the necessity of the research using their own cultural lens, allowing them to make meaning of their past and present experiences in connection with current neurophysiology research through avid discussions. This method also sought to drive the
participants towards action and ownership by asking the participants about the possible pathways the researcher should investigate when attempting to implement this research. Qualitative data also helps account for linguistic equivalency. Vocabulary can be defined and explained through conversation as compared to written questions, observations allow for an alternative to self-reporting, and the participants use both etic (cross-cultural) and emic (singular culture) perspectives during their discussions. The quantitative data provided the researcher with baseline figures that could then be compared to the qualitative responses and allows the researcher to identify trends. The analysis and interpretation of the data was then converged to create a broader understanding of the research questions.

One week after the consent form distribution, the researcher issued the pre-study survey to all students and gave them class time to complete it (See Appendix A). The researcher reminded the students to respect each other's confidentiality and not ask questions regarding another’s participation in the study. For the next three weeks, the students participated in four focus group sessions which included all students, regardless of direct participation in the study. The students were introduced to neurophysiological research and then asked to work with other students to answer and discuss the research questions on a piece of paper (See Appendix B). The researcher walked among the focus groups during this time and wrote down analytic memos by hand in their research notebook. All participating students were divided into focus groups of their own while non-participants were grouped together. This made it easier for the researcher to address the participants directly and record their responses via the researcher's cellphone. After each focus group session, the researcher collected the question answers, made copies of the participant’s answers, and stored the paper data in a filing system. After the final focus group
session, the students were provided with the post-study survey via Google Forms and were given class time to complete it (See Appendix C).

The researcher distributed parental consent forms one week after the student consent forms. Parents were provided with a pre-research Likert scale survey and a scheduled time to conduct the interview once they returned the forms (See Appendix D). During the interview, the researcher introduced the neurophysiological focus group topics that the student’s had received, weaving in the research questions as the discussion moved along (See Appendix E). This allowed for a fluid conversation and for the parents to provide a narrative response to the questions. The researcher recorded the interview using their cell phone and took analytic memos in their notebook. All interview answers were kept in the researcher’s Google Drive folder, in their research notebook, or in their paper filing system.

**Data Analysis**

**Surveys.** The quantitative data from the surveys was gathered via Google Forms and was then automatically transferred into a Google Spreadsheet. This data was then transferred to Microsoft Excel which generated bar charts for the research questions.

**Interviews and Focus Groups.** The qualitative data from interviews, focus group transcriptions, and analytic memos, was open coded by hand by the researcher for both expected and unexpected codes (Creswell & Creswell, 2018). Some of the expected codes from the parental interviews included “devoted programs,” and “sounds familiar.” Some of the unexpected codes from the interviews included “constantly changing routines,” “simple and direct,” “realizing need,” and “on her own.” Some of the expected codes from the student focus groups included “school as the medium,” and “personal responsibility.” Some of the unexpected codes from the focus groups included “better the system,” “ghost majority,” “clarity,” and “peer
to peer communication.” Concept mapping was utilized to determine the major emergent themes of each research set. After, the narrative analysis strategy was used to gain a deeper understanding of the data during participant discussions which allowed the researcher to identify the “relationships among the different parts of the transcript or field notes” (Maxwell, 2013, p. 113). Finally, focused coding was used to search for specific words or phrases that appear across transcriptions and notes.

Validity

To provide validity of the study’s results, the researcher took advantage of five strategies of validation: triangulation, intensive long-term involvement, rich data, respondent validation, and discrepant evidence (Creswell & Creswell, 2018, pp. 200 - 201). When collecting data, the researcher gathered multiple sources and forms of data for triangulation. The researcher used a mixed methods approach with two separate populations: students and parents. Data was gathered from students using two quantitative surveys and four qualitative focus groups sessions. Parental data was gathered using one quantitative survey and a qualitative interview (Creswell & Creswell, 2018, p. 200). The survey and focus group session/interview data converged with the observations made by the researcher and their analytical memos to derive meaning and codes.

The researcher also “[spent] prolonged time in the field” as the classroom teacher of the participants. This allowed the researcher to develop a greater understanding of the theme of the research and they were able to “convey [details] about the site and the people” involved from a deeper and more accurate perspective (Creswell & Creswell, 2018, p. 201). The researcher was able to compare their current thoughts and feelings about this research to their previous experiences and reactions in the classroom, which provided the researcher with more evidence and understanding when breaking down the data and any cryptic meanings.
The researcher used member checking, also known as respondent validation, to increase the validity of the interpreted responses. During the focus groups sessions and interviews, the researchers would present the qualitative answers back to the participants to double-check and clarify statements. The participants then have opportunities to “comment on the findings” and determine the accuracy of the evidence (Creswell & Creswell, 2018, p. 200).

The research made sure to collect and analyze any discrepant evidence derived from the data. This type of evidence includes any findings that differed from the normative or expected results (Creswell & Creswell, 2018, p. 201). It is important to acknowledge any results that differ from the researcher’s expectations and use them during analysis to gain a better understanding of the data itself and what the participants are revealing during the conversations. Ignoring such data would lead to biased results that do not capture the whole picture.

To represent the data, the researcher used rich data descriptions to “provide detailed descriptions of the setting” using vignettes and direct student and parent quotes to illustrate the researcher’s personal moments during focus groups and interviews thus creating a “more realistic and richer” context to the study (Creswell & Creswell, 2018, p. 200).

**Research Positionality.** In college, the researcher studied neurobiology, physiology, and behavior science as well as psychology, uniting the worlds of both neurophysiological development and learning. The researcher developed an in-depth understanding of the academic struggles of secondary school students both before and during the COVID-19 pandemic. These struggles lead the researcher to search for ways to support students both in the classroom and at home, since most learning either succeeded or failed to take place at home. These two experiences influenced certain biases. For example, the researcher was predisposed to thinking that students may need interventions from the home, even more so than school. When the
students were sent home to learn, many failed to complete even simple tasks and assignments, meaning that their ability to self-regulate or set themselves up for academic success needed to be investigated. Another bias arose from the researcher’s background in neuroscience, where the researcher keeps up to date with current research using online new channels and podcasts from renowned professors. This influenced the researcher to investigate neuroscience specifically when discussing how to help students, instead of a different subject of research.

Finally, the researcher is of Hispanic descent which led to their desire to assist families with culturally and linguistically diverse backgrounds who truly struggled to support their students before and during the pandemic. These families have many concerns already and would benefit from non-invasive interventions that they could begin to employ with their children.
Chapter 4: Findings

This project sought to discover how high school students and parents perceive the implementation of neurological data into their daily lives. After concluding the research study and analyzing research notes derived from student and parent surveys, student focus groups, and parents interviews, the researcher found that while students agreed that having access to this scientific data would be useful for them, they conjectured that there is a majority of people, who the researcher has identified as a “ghost” majority—of individuals, who would fail to understand or attempt to understand the importance of the research, thereby creating a phantom psychological barrier to implementing research. Second, the research also showed that neurophysiological research can best be implemented into the high school student’s life by addressing the need for such research directly with the individuals involved and allowing them to maintain personal responsibility and peer to peer connections during implementation. The importance of peer-to-peer communication was also revealed when discussing how educational institutions can begin to bridge the gap between school officials and culturally and linguistically diverse families. It also became apparent that parents of high school students are open and aware of the need for such research and can help overcome the challenge of student passiveness and misinformation if given the opportunity to echo and receive clear and direct implementation goals from the school.

Issues with Implementation: the “Ghost” Majority

During the neurophysiological presentation sessions, the students addressed the presence of a majority of individuals in the community who would reject or “not care” about the research that is presented to them. They believe that there is a large subset of their peers who would not absorb the information or gain anything from it. This thought pattern even led one student,
Rebecca, a student from focus group number one, who has been engaged during all the previous presentations to remark, “What’s the point? Just leave it alone. People won’t actually change.” Rebecca engaged with the content of the presentations during the first three presentation sessions but made this statement at the end of the fourth presentation. While Rebecca is a student who frequently needs to be redirected during academic work, she appeared to relate to and show interest in the strategies presented during the sessions, therefore this negative statement gained the researcher’s interest and deep reflection. Rebecca continued her thought and stated that this level of concern and effort towards change, referring to the implementation of neurological strategies, should be saved for larger movements, such as Black Lives Matter. At first, the researcher felt disheartened by these types of student responses to the assumptions embedded in the research focus but became curious how this barrier might be overcome. It was in the language of one student from the second focus group where the first revelation appeared unexpectedly.

**Vignette 1: A Discussion About Placebos**

In one of the second rounds of presentations with focus group number two, a group of students proceeded to ask questions regarding the neurological data and research that was presented. They presented mild interest in the information at first. When offered a choice of topic, many of the students expressed interest in the science behind looking at their phones and their ability to lower their stress levels, which the researcher noticed may be because they feel a deeper connection to these topics during the pandemic. When talking about stress, the researcher emphasized, “Your body can actually change the release of its hormones based on what you tell yourself! Isn’t that wild? You can change what is happening in your body.” One student yelled out, “That’s like a placebo!” Confused looks covered some of the faces in the class, so the
researcher began to define what a placebo is. Jessica, another student in that group, admitted, “I’ve heard something like this before…,” and then added, “That is like when a woman has a ghost baby.” The confused researcher asked, “What is a ghost baby?” Jessica continued, “It's when a woman thinks that she has a baby in her, but it's not there,” She says as she moves her hands near her stomach, “She just thinks she is pregnant.”

Jessica’s language was distinctive, but also helped the researcher understand what she had experienced during the presentation as well — namely, that students have developed ghost ideas about people. They assume some majority exists. Just like the existence of the “ghost baby,” a “ghost majority” exists in the minds of the students in this focus group.

Vignette 2: Don’t Let it End and Make it Mandatory

During one discussion with focus group three, the researcher was making their rounds, when Daisy called out asking, “When will this be over?” and then quickly added, “It’s not like I want it to end, I’m just wondering.” Another student chimed in, “I actually don’t want it to stop either, this is actually interesting.” The researcher answered, “So this is our third of four sessions. We will have one more after this which will happen sometime next week and then we’ll be done.” The students seemed disappointed by this answer. Ana, who was sitting at another table stated, “I actually like talking about these topics.” The students had begun to identify that they found implementation science both relevant and interesting for learning and their lives.

The researcher was even more surprised by the empathic concern and then summary prescription made by a group of students in focus group two, after sharing some neurological research, and asking, “Do you believe there are any issues when it comes to introducing this science to others?” Trevor replied “So, [the] data can be misrepresented and used incorrectly.” Sarah raised her hand and asked, “Can I add to that? People could get a negative attitude about
the research.” When asked to clarify, Sarah suggested that the research may ask people to change their habits or lifestyles and that people would not like that. The class seemed to nod and agree with her. The class began to lighten up at this point in the discussion as several students began to bring their own experiences to the mix. The researcher then asked the class how the introduction of the information could occur in a way as to dispel negative attitudes and misunderstandings. Trevor sputtered, “I think we can make it like vaccines, just like the medical requirements we have now. People might not want to learn this on their own, so it should be mandatory and done in school.” The research was taken aback a bit, “You want to make it mandatory?”

It had become clear that the students see this information as important, so important in fact, that they would be willing to make it a requirement for their own education. They enjoyed talking about their own experiences when it came to the neurological data and learning about new skills and techniques that they can integrate into their own lives. Interestingly, these comments came from students, in the second focus group, who had a rough time engaging with the academic content of the course. At this point, the researcher had spent more than a semester with these students and had trouble drawing them into the class. The positive comments, of not wanting to end the focus groups and a stated desire for more information and discussion showed the researcher that this neurological content is truly meaningful to teenagers, even the ones who disengage on other topics.

**Vignette 3: On Sensitive Environments and Inclusivity**

One of the questions being addressed during the fourth and final session asked about the best location for the implementation of neurological research, and to distinguish between either home or school. While prior research suggests that the home and school should work together to support the whole student, that research is based on the suggestions of parents and school staff.
This study aimed to address the student opinion on the matter, therefore encouraging them to decide between both places separately. A student from focus group one, Nancy, was torn. In her opinion, school already asked too much of her, and therefore it would be difficult to learn even more content. However, Nancy also stated that not everyone’s homelife is the same, and that while some students may be able to learn this information and use it at home, others do not have the stability or security. In the end, she decided that school would be the more viable option for most students, even though adding this additional task could potentially overwhelm some of them. Other students also felt that school would be the better option. Ana, a rough and tough student from the third focus group, wrote that these changes and implementations should occur at school but not in a way that would make people feel bad or get an “ED” like she currently believes happens. ED is in reference to the development of an emotional disorder, a diagnosis she currently deals with and is very open about with others.

June, from the third focus group, wrote that school is where they are for almost the entire day, it's where they are most influenced, and therefore should be where implementation occurs. However, Franklin, from the third focus group, made a strong argument for research implementation occurring at both locations. He believed that high school students were at an age where they should be personally responsible for implementing these types of strategies and they can begin to “start doing [these strategies] by him/herself in their free time” outside of the classroom. However, the students would first need to learn about the strategies in school. Out of the nineteen students who participated in the fourth presentation session, thirteen of which are of Hispanic descent, three White, one Asian, and two of more than one ethnicity, four stated that they would prefer the home as the place of implementation, nine chose the school, and six chose both. Of the thirteen Hispanic students, only three saw their home as the preferred location, while
six see school as the more “effective” environment and where they learn “new exercises.” In total, many students saw school as the desired location for initial implementation/introduction of new strategies.

**Figure 5**  
*Student’s Preferred Location for the Implementation of Research*

![Graph showing preferred location for implementation](image)

However, from these discussions, the researcher recognized inequities that could preclude certain populations from making use of the science in equitable ways if the research was only implemented in one setting. Both populations of students overwhelmingly suggested that school should be the main or partial place of implementation if we want to see real change occur. This is because they spend most of their time at school so this would be where they are “likely to stay on track,” and not become distracted or “forget” about what they learned in school by outside responsibilities such as babysitting siblings and homework. However, students like Nancy, feel overwhelmed in school and may require a separate environment to dive into using new neuro physiological strategies. Likewise, Isabella, Kara, Rebecca, and Valeria suggested that they already “do plenty enough” at school and home is “the root of all [behavior] [development] in
people,” making it the most effective place for change. To gain a further understanding on this debate between home and school, the researcher asked the students: Who is responsible for protecting the teenage brain? If it was the school, then the researcher would suspect answers such as educators and teachers and students. If it was at home, then the researcher would expect their answers to be parents or caregivers. Interestingly, the students rarely mentioned teachers or educators. Instead, the students pointed out that it would be the owners or the brains and their parents that should be responsible. This was represented amongst all populations.

*Figure 6*
*Student Responses to Who Should Protect the Teenage Brain*

![Bar chart showing student responses to who should protect the teenage brain.](chart.png)

This data suggests that both locations need to be responsible for implementing neurophysiological strategies, with the school providing a safe space for students to engage with the research and the home providing a place where students can practice their strategies and feel a greater sense of responsibility since they are bettering themselves without the direct oversight of their teachers.

Beyond the “ghost” majority, students identified a few other unexpected challenges including trying to sort the large volume of available data and resistance to breaking current
habits. During the second presentation session with focus group one, Justin, a student with a 504 plan for his dyslexia diagnosis and who frequently engages with the academic curriculum and knows how to be outspoken about his 504 services, appeared optimistic about the accumulation of research but mentioned that he thought it would be hard for others to adapt to new information that would change habits they have developed over their lifetime. Since Justin is a student who must always adapt and adjust for any academic class, he is aware of the hardship this can place on others. Justin also stated that people could feel discouraged when they begin to compare what research tells us and how they currently live. Leslie, a student from the second focus group, echoed this concern stating that people could begin to reject research that did not conform to their current lifestyles and beliefs, even if they could find it useful. Rebecca added that it can be difficult to change the minds of Hispanic parents, such as hers. In her opinion, Hispanic parents maintain narrow views about their beliefs, especially regarding their children, therefore making it far more difficult to implement new ideas or trends into their households. “Believe me,” she said, “I would know.” Nadia, also from the second focus group, added to this idea, writing that one way to relay this information to the local community would be to make parents listen to their kids and try to understand them.

However, despite these concerns, many students pointed out that this type of research could prove to have important advantages. The integration of the research could lead to systemic change, giving the younger generations the tools they need to understand their bodies and make intelligent decisions as they age. Ana, from focus group three, provided a particularly moving example when sharing that, “[my] [mom] messed [me] up” through the use of narcotics and other substances during pregnancy, leading Ana, in her opinion, to develop conditions such as clinical depression and anxiety. This goes along with the other advantages laid out by the students,
saying that the research can help shape the rest of their lives and provide them with the opportunity to protect themselves and those that come later.

While there were concerns from the students that a ghost majority would resist successful implementation of neurological science and practice, collectively, the students in the study stated that this type of research is important and relevant during teenage years and within their own lives. This sentiment was echoed by all students despite their multitude of cultural and linguistic backgrounds when the students overwhelmingly stated “Yes” to the question asking if the research strategies presented were relevant to their lives and the lives of their peers.

Figure 7
Student Take on The Relevance of Research After Focus Group Presentations

Honoring Student Influence with Family and Peers

Throughout the research, students consistently noted that successful implementation must consider each individual and both their personal and cultural background, as well as empowering a student’s own sense of responsibility. Specifically, the students made it clear that they are the individuals responsible for the use of research in their lives. The researcher also discovered that students found people who were closer to their age as being more reputable sources for insight on neurological science.
Student Influence and Responsibility

The idea of responsibility appeared in both quantitative and qualitative data sources. During the pre-survey, the participants showed little interest or regard towards using university research in their lives, saying that they would not be entirely willing to make changes to their home environment based on current research and that current research from universities does not relate to nor can it be applied to their lives (See Figures 8-9). Students of all ethnic descents and language backgrounds stated that finding research is not easy for them, that they are unfamiliar with current research (See Figures 10 - 11). Additionally, these groups stated that a student’s environment outside of the school can affect their brain development and learning capabilities, with nearly all students, despite cultural background, totally in agreement (See Figure 12). However, while the populations agreed on these topics, the Hispanic population found it more difficult to find current research and identify its relevance to their lives.

Figure 8
Pre-Survey Response: Student Willingness to Make Changes Based on Research

![Graph showing willingness to make changes based on research](image)
**Figure 9**  
*Pre-Survey Response: Student’s Belief that University Research is Somewhat Related to their Lives*

![Graph showing current research related to life](image)

**Figure 10**  
*Pre-Survey Response: Student Belief that Neurophysiological Research is Not Easy to Find*

![Graph showing ease of finding research](image)
After the research sessions had concluded, the students participated in a post-survey where both groups began to show appreciation for the importance of implementing research and stated that they would both feel confident in integrating and want to integrate some of the presented research into their lives.
Figure 13
Student’s Confidence to Integrate Research into their Lives After Focus Groups Presentations

These statements display a clear growth in the students’ mindsets surrounding what the research truly is and how it can be useful to their lives. There was broad agreement when “I” statements appeared in the post-survey, indicating the power they felt over their ability to understand and use the research once it was presented.
This confidence was also reflected when the students stated that they are the main individuals responsible for the development of their neural pathways, as compared to parents or school officials during the post-survey and focus group discussions (See Figures 15-17).

**Figure 15**
*Student Opinion on Student Responsibilities Over Teenage Brain Development*

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I am the Main Individual Responsible for the Development of my Neural Pathways.
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**Figure 16**
*Student Opinion on Parent Responsibilities Over Teenage Brain Development*

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Parents are the Main Individuals Responsible for the Development of my Neural Pathways.
```
One student from the first focus group, Stephanie, described how students should receive “forces and mandatory units,” take the research information they learned in school back to their homes, and present to their parents. This surprised the researcher since it took the burden off of the teacher and school and placed the responsibility on the student. Instead of the school sending the information home, this suggestion implied that students would be willing to become the fulcrum for implementation of research into their lives and their households.

This sense of autonomy surprised the research and was highlighted during one of the second presentation sessions, where the students were invited to stand up and move to the back of the classroom. They were then instructed-to move to either side of the class based on if they thought that a particular statement was relevant or irrelevant to their daily lives. The researcher called out the statement, “You usually feel sleepy in the morning,” and waited for the students to move. She then nodded and proceeded, “It is difficult for you to get to sleep at night,” and again the students shifted around. A few students were messing around and missing the statements, but most were poised and listening. In response to a series of questions, the researcher noted to the
class that, “Apparently Stephanie, Rebecca, and Rose all get great sleep, never feel sleepy, and don’t drink caffeine in the morning, magical.” The session continued with ease and light humor like this until the researcher posited the next prompt: “Your sleeping pattern is determined by someone else, not you.” Stephanie then interrupted by saying, “I don’t know what that means,” as she stood in one place. The other students looked at the researcher with blank faces. The researcher replied that, “This would mean that like someone else besides you, your parents, older siblings, would be in charge of when you go to bed, like give you a bedtime.” All the students then suddenly shifted to the “No” side of the room. “You determine your own bedtime?” asked the researcher with amazement, “All of you? No one tells you when to go to bed?” They all nodded with some of them giving quick “Yeps” and “Yups” with confidence all over their faces.

The sense of student independence was further supported by parents during their interviews for this research. Mia C., a parent of a student in focus group one, directly addressed the ability of a parent to integrate research into the lives of their child. She was asked, “Do you ever feel like it's difficult? Like if you wanted to bring [research] into your kid’s life…is there anything that stops you?” Mia replied, “If it's about sports, or concussions, it would probably be my husband…But mostly just because they are teenagers right now…it's so hard to talk about anything that is not directly…connected to whatever it is they’re passionate about.” Nodding, the researcher urged the parent to elaborate. “[They] shut down so many things,” she continued, “But [my student] was talking about [this research] the other day. So, if I hear them start, you know they don’t talk much about what happens at school. I think it's just the natural progression of things, [when] the kid [is in] high school that you, you know, take a step back, and they gain that independence and the communication, it falls more on their shoulders.”
At least for this community, both students and parents believed the students held the greater influence in determining what would be discussed. And from the position of implementation science, this influence is central toward understanding the pathways for distribution and integration. As such, designing a space for personal responsibility would allow students to integrate their passions into the participation and application of research. Personal responsibility, then, could also be a tool to address both cultural and linguistic differences amongst target populations. It could be the individuals themselves that determine the topics and since they themselves are culturally and linguistically diverse, they would be able to choose and implement appropriate and relevant neurophysiological research-based strategies.

It’s worth noting though, that not all students felt that they were the only ones responsible for implementing this type of research. For instance, Geoffrey and Renee from focus group three, stated they themselves have the job of protecting the teenage brain, but that “older people [who] give influence” to teenagers should also be responsible for caring about this implementation, and referenced “older people” and “influencers” as additional responsible parties. Rose also felt that “adults should help” with implementing research “because they have more power” and adults “who interact with teens [such as] family members” should take special care and consideration. However, she also agreed that it would be important to “inform teens [of this research] so [that] they can protect themselves.” The idea of “caregivers” and adults with direct influence over teenagers having important impacts was brought up by multiple students as important considerations on whose “job” it was to protect teenage brains and bodies using research. Accessing the information at school would give the students power on what they chose to take home and what they would like to implement in their own lives, as compared to having guardians or parental figures in control of what research matters.
**Peer-to-Peer Communication**

The desire for independence was also evident when students revealed who they felt they should hear the research from. Rebecca noted that research can appear old if older people are the ones asking the student to investigate it. She stated that “parents are old, and they believe in old rules and stuff.” When asked to clarify, she stated that they would not understand the needs and perspectives of the younger generations, and that what the older generations care for or believe in would not hold true for teenagers or those even younger. Therefore, she would be more interested in and willing to listen to information presented by her peers or individuals who are younger than her parents.

Justin mentioned that research can appear outdated, and he himself believes that some old research will become irrelevant as the years pass. The researcher asked Justin if he believes that all scientific studies will become outdated and gave the example of gravity and other scientific laws. In response, Justin stated that research itself, if conducted by people of the past, can automatically seem old and immaterial for current age groups.

It was apparent through many of these types of conversations that age matters when it comes to how students evaluate the value and relevance of research and that older individuals may experience research differently than teenagers and younger generations and the values of a particular generation. Students also appear to place a high value on novelty. Learning new research, then, would need to come in a form that makes it approachable to the younger generations, meaning that one method would include it being presented by their peers.

**Even Adults Privilege Peer Sources.** The researcher experienced an interesting parallel series of revelations about “who” matters and is seen as a reliable source of information, first, when discovering that Spanish speaking parents wouldn’t end up participating in the research and in talking with an English-speaking parent who also works as a teacher in the district.
When the researcher asked for parental involvement, one student yelled the question, “Do you speak Spanish?” from across the room. While the researcher is of Mexican origin and maintains a limited working proficiency of the Spanish language, she nervously admitted that it would take Google Translate and other means of translated communication for her to host parent interviews with those who only speak Spanish. The students in that class displayed a clear hesitancy surrounding parental participation after that question was asked and the researcher was disappointed by the reaction of the room. During parent recruitment, the researcher was unable to obtain any parents permission slips from the Spanish-speaking community or Latinx origin, even though there were Latinx students who produced Spanish-translated parental permission slips for the student surveys and focus groups. This shows that there were several Spanish speaking parents who were not against the study for their students, while they themselves did not participate. There are many factors that could be considered as to why they did not participate, but perhaps the researcher would have been better able to reach out to parents if she spoke the same language.

A parent interview with Mia C. added to the researcher’s understanding of the importance of peers. She is a teacher at a neighboring district and is frequently asked for advice from other parent-friends regarding their student’s academic progress and the inner workings of the school. While discussing if parents reach out to her for information, she stated, “Yes, a lot [of parent friends] reach out to me, because they know that I can serve as a resource…but…not many of my…student’s parents [reach out].” She further offered that, “I don’t know if they have the information, or [if] they don’t.” Even though she recognizes that she “[gets] so many questions from [her] parent friends” she hardly ever has to answer questions from other parents, which she then realized that she had “never thought of it like that.” The researcher, who is a teacher herself,
stated that if teachers know anything, it is that if one student has a question about a topic, then it is highly likely that multiple more have the same question. Mia nodded and agreed and asked the rhetorical question, “So who are [the parents] getting that information from?” The researcher has similar experiences. She also does not receive many questions from her students’ parents but will be asked about the school proceedings and current events from friends and neighbors. If the school hopes to implement neurophysiological research into a student’s daily life, then they would need to identify a path to reach out to the parents and become peers that the parents trust and feel comfortable with.

Clearly, there is a significant amount of comfort when it comes to reaching out to individuals a person knows, trusts, and sees as peers, as compared to strangers or some “othered” authority. This data suggests a disconnect and unfamiliarity between teachers and parents, between students and research, and between parents and information, and yet a need and desire for information.

**School as the Backbone for Equity**

Throughout the research, both students and parents identified the school as the preferable location for implementation science noting how schools practically serve as a primary source of information about child and teen development for these families. And despite the gap that may exist between some teachers and parents (as noted in the previous section), schools were recognized as being able to address and access diverse families and their various cultural and linguistic differences.
A Desire for Increased Clarity

Both parents and students communicated to the researcher that they were both interested in having access to the research and often had some vague memories and experiences of being exposed to neurological development research. However, they also admitted that they weren’t clear about the research, nor understand how to effectively access the research or apply it in their lives.

Parents

The results of the parent survey showed that parents would be willing to make changes at home based on current neurological research, that they would attend meetings at the school for research presentations, and that the school should be responsible for providing students and parents with information on adolescent brain development. They also acknowledged that they were aware that their child’s environment outside of school affects their brain development and learning potential. However, the parents indicated that they are not entirely familiar with current neurophysiological research, nor do they find it easy for their family to obtain or read this type of information.
Figure 18
Parent Willingness to Make Changes at Home

You Would be Willing to Make Changes to the Household if Suggested by Current Research About Adolescent Brain Development and Learning.

- Always
- Often
- Sometimes
- Not at All

Figure 19
Parents Willing to Attend Meetings

The School Should have PARENTS Attend Meetings About Adolescent Brain Development and Learning.

- Always
- Often
- Sometimes
- Not at All
**Figure 20**  
*School Should Provide Parents with Neurophysiological Research*

The School Should be Responsible for Providing PARENTS with Information on Adolescent Brain Development.

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**Figure 21**  
*Parents Aware that Student’s Environment Outside of School Affects Learning Potential*

A Student’s Environment Outside of School can Affect their Brain Development and Learning Capability.

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Similarly, during parent interviews, all the participants recognized or were slightly familiar with the neurophysiological research presented, but admitted their knowledge remained limited and indirect. For instance, Leila S. recognized the information about adolescent neurophysiological development and specific strategies regarding phone use and attention because she had attended past meetings with counselors at her child’s middle school. These
meetings included “a series…around brain development” that allowed parents to develop a greater understanding into the “why” behind a child’s actions. Leila also stated that she has heard of a “mindfulness program” at a local elementary school and believed it was “wonderful” and that “we [should probably] have that [type of information] in … high school.” Mia C. also stated that the neurophysiological information presented “[sounded] familiar” as well, and how just hearing about research in general can make “[us] more aware of it,” give it an “identity” and allow us to “recognize it more frequently” in our kids or in our lives. Like Leila and Mia, Jasmin J. recognized some of the research points and strategies but mentioned that “it's been so many years” since her last exposure.

Mia added that as a fellow teacher, she “[knows] things that other parents have no idea about” and that she has parents that “were in high school forty years ago,” creating a gulf between both current ideas about teaching and the science itself. She also noted that they also often have limited knowledge about or engagement with the inner workings of the district.

During her one-one interview, Jasmin admitted to hesitating during the previous survey, and later told the researcher that she did not “have the knowledge of the brain development [necessary] to know how to answer the questions” posed. This raised a red flag with the researcher, because the questions were written in a way that did not require previous understanding. For a willing and ready parent to encounter a barrier when answering questions about their student’s neurophysiological development shows a clear problem with perceived clarity and access to information. Recognizing this need, Jasmin did ask the researcher for a checklist of neurophysiological strategies and age-appropriate recommendations to use daily. Collectively, the parent survey responses and interviews illustrated the need for more
information and clear strategies surrounding parental exposure to age-appropriate
neurophysiological strategies and research specifics.

Students

Like their parents, students expressed a desire for clearer guidelines about how to access
and use neurological research. As noted earlier, Trevor pointed out how some of the research
could be used for the wrong reasons or in the wrong way if researchers fail to provide clear
instructions on its applicability. Justin brought up the importance of considering how different
people might use identical research strategies, but then encounter different results. This could
create confusion amongst the students trying to benefit from the strategies, compromise faith in
research generally, and even lead to pessimism. At one poignant point during a focus group
conversation on the topic, the researcher observed Nancy to take a moment to just stare off into
space before uttering, “too much research.”

Through these examples and many others, students brought attention to the care and
attention necessary to create a culture of credibility, clarity, relevance, and practicality with
regards to implementation science, lest the students lose faith in the value altogether. The
students note that when someone presents research to them, they must make time for the students
to fully digest the information, to ask questions, to address variability, and to create succinct and
direct summaries of the research that they can access without feeling overwhelmed.

Increasing Access

Both parents and students recognized the importance of the research, yet also admitted
they fail to apply neurophysiological findings purposely or deliberately during daily activities.

Parents Want Checklists and Community Events. Parent participants brought up the
issues of time and community. Jasmin J. shared that she needs to rush her children off to
different schools every morning and barely has time to consider anything more than her kids “[getting] a heavy breakfast” and heading out the door. She also mentioned that their routines change each year when kids start to incorporate new activities into their schedule. This not only applies to the next school year but they “[have] to make adjustments … each semester” for every family member. The larger the family, the more adjustments that need to be made. Attempting to incorporate outside research at this point can feel impossible and overwhelming. Jasmin did provide one recommendation, stating that “just [by] having a printout of [the research strategies] or even … a checklist of just new habits to incorporate into [their] family life” would make it much easier to implement research strategies and work towards addressing the needs of her children as they age. This type of document would allow parents to have simple and direct examples that they can try and address during their changing schedules. Her recommendation implied that it would be school staff that could provide families with this type of document. This suggests that the school can help bridge the gap between families and research.

Leila S. stated that “the school would be great in terms of … brain development research” and gave examples of other schools in the area hosting family movie nights. The “school [sponsored] the event and families [were] invited” and “a lot of families” chose to attend. The school mentioned here does attend to a more privileged student population and Leila addressed this difference. She stated that, “Our families at Eureka High School are all different [from one another and those around us], like a lot of families are working. We always have things in Spanish and English, but we were all basically wanting our kids to be healthy.” Leila added that it would make sense for families to come to the school for direction and strategies “as long as [there is] an awareness of the needs of the community.” Again, here, the school is bridging the gap between families and the research through hosted events.
Mia C. shared that she felt that most of the “community and communication and interaction came” from “being on campus” or becoming involved in groups that met during working hours. Any parents who work these hours have potentially missed out on becoming part of the school community. If you happen to have a “set schedule” you would feel “disconnected” and separate from the school and your student’s school day. However, Mia mentioned that the pandemic has worked to alleviate some of this disconnectedness with the introduction of Zoom and the increase of work-from-home positions. She noted that some parents are now officially work-from-home employees, providing an increase in work flexibility, and for those who are not, they can now access Zoom hosted meetings and events that are able to “take place at different times” throughout the day. With new technology, the school can begin to reach out to larger parts of the once distant community.

**Students.** During pre-surveys before the focus group presentation sessions, students indicated that they thought it would be difficult to find research that is relevant and useful for them (See Figure 10). Notably, after the focus group work, post-survey results showed an increase in the understanding of the importance of research and the willingness of students to implement it in their own lives (See Figure 7). However, during the post-research survey there were low score responses related to the (1) ease of finding the research (2) how easy it would be for their families to integrate the research into their household, and (3) their feelings towards their family’s willingness to integrate the research.
**Figure 24**
Students Find it Somewhat Difficult to Obtain and Understand Neurophysiological Research

**Figure 25**
Students Believe it Will be Difficult for their Families to Integrate Research into Households
Students Believe their Families May be Unwilling to Integrate Research into Households

These opinions appear to stem from the initial misunderstanding of what “research” is. During the presentation sessions, the students received relevant examples of current research which elevated their understanding of the term. Once they were able to comprehend the meaning, all participants maintained positive mindsets regarding the possible integration and desire to integrate research into their lives as seen in the figure above.

**Conclusion**

The research sought to address the question of how the school can begin to help families integrate neurophysiological research-based strategies into the daily lives of their high school students, with consideration for students with culturally and linguistically diverse backgrounds. The study sought to answer four research questions: (1) How do students believe current neurophysiological research can best be implemented in their daily lives to enhance their academic success and learning abilities? (2) How do culturally and linguistically diverse students believe neurophysiological research can best be implemented in their lives? (3) What challenges exist regarding the implementation of neurophysiological research into the lives of high school
students? (4) What do students and parents need to effectively implement research-based strategies into their lives?

Findings from this research study indicate that high school students and their parents understand the importance of implementing current research-based strategies in their daily lives, despite the cultural and linguistic differences found amongst the participants.

Before the focus groups, the majority of students expressed a misunderstanding of what neurophysiological research is, but by the end they were able to comprehend and state that they place value on such research and are willing to use these research-based strategies daily. Participants offered implementation strategies for the researcher including the use of peer-to-peer communication techniques for research delivery and allowing the students to be given personal responsibility over the discovery of strategies they wish to use in their lives and share with their families. Both implementation strategies increase the relevancy of the research and tackle issues concerning cultural and linguistic differences between the participants and the research.

Challenges towards the implementation of neurophysiological research were discussed. Students offered feedback towards implementation, bringing up issues surrounding acceptance, perception of the research, and sensitive environments that students find themselves in. Students reported that some members of the population may not accept the research, therefore eliminating the possibility of implementation. However, these suppositions seemed to point to a “ghost majority” since all the participants involved stated that they find the neurological research strategies important, and they were willing to use them in their own lives. Who this population is, then, is unknown, and most likely not the majority they are perceived to be. The students also brought up challenges with the sheer amount of research that was presented to them and stated that this could lead to confusion or misrepresentation of the research if not explained correctly.
Parents and students offered solutions and strategies for the implementation of research. Both groups looked towards the use of the school to increase the understanding and accessibility of the research for busy and working families. This would allow the school to work as a backbone of the community and provide equitable access to neurophysiological research-based strategies for all families to use outside of the classroom. The students that attend this school are considered the “diverse” population relative to all surrounding high schools and have parents who work long hours and exhausting trade jobs and who may not earn the same income as the “non-diverse” student populations whose parents have white-collar jobs. How then, are these blue-collar parents, and frankly any parents, supposed to help develop a learning environment based on up-to-date neurophysiological strategies if they are limited on time and energy. During the COVID-19 pandemic, the school district expected families to be able to manage their student’s daily actions without providing information regarding best practices. This task, of having your student learn from home, was impossible for most and difficult for all. The findings of this study aim to help increase the equitable attainment of current research for all families of this community.
Chapter 5: Discussion

The findings from this study document the willingness of high school students and parents to implement neurophysiological research strategies into their daily lives. In addition, the data discusses notable issues surrounding the application of research, outlining problems involving individual misconceptions and misunderstandings of the research, a phantom subpopulation who would refuse to participate in the research, and research accessibility. Finally, the study produced potential implementation strategies that may act as solutions such as allowing the students to develop personal responsibility over the research they learn about, peer-to-peer communication techniques when dispensing the research and using the school as a means of connecting students and families to current research-based guidance and information.

In the following discussion, the author highlights the consistencies of this study’s findings with prior research outlining the importance of implementing neurophysiological research-based strategies during the adolescent years, how research fails to make it to its intended target populations, and the necessity of building FSPs (Soicher et al., 2020; Griffin, 2017; Hannon & O’Donnell, 2022). This discussion will also, however, outline important differences between prior research and this study's findings such as exactly what students and parents need from the school to implement research strategies outside of the classroom and specific strategies students can use to increase the odds of implementation. This discussion will then examine how teachers, families, school districts, and district policy makers can use these findings to help high school students and families implement critical research-based strategies in and out of the school setting. Finally, this discussion will state reasonable limitations to the methods used during this research study and advise on future endeavors exploring the implementation of research-based strategies into the daily lives of high school students.
The findings of this research mirror notable conclusions of previous studies discussing the importance of neurological development during the teenage years, the gap between research and practice, and the necessity of building community and communication between the school and families. Griffin (2017) suggested that the teenage years were ideal for neurological development, and this concept was reciprocated by students and parents. Both groups understood the need for taking care of the teenage brain and promoting the fundamental development of neuron connections and white matter development using neurophysiological research strategies but recognized their information deficit. There was a realization that neither group had the tools necessary to encourage this development, suggesting the existence of a “research-to-practice gap” between neurophysiological research strategies and the target populations of students and their families (Soicher et al., 2020).

These findings also reinforced the need to build connections between school officials and families and treasure the parent voice when it comes to helping students improve their neurophysiological development. During the study, parents suggested that the school act as an agent of information dissemination, which agrees with the strategy of forming FSPs to better address the individual cultures and perspectives of students and families (Hannon & O’Donnell, 2022; Smith et al., 2020). Another idea that came about was the implementation of informal events. One parent mentioned the benefits of district-hosted family nights, where the parents and teachers could mingle without the pressure of a formal setting. This was emphasized in the research conducted by Costa and Faria (2017), when they found that these events could lower tensions between parents and school officials and build positive relationships. Allowing for these partnerships encourages both students and parents to feel more comfortable and connected to the
education system and would allow the school to better implement important research into the lives of students outside of the classroom.

This study answers questions asked by previous research studies by addressing what students and parents require to implement research and how to address culture with culturally and linguistically diverse high school students. To implement neurophysiological research, both parents and students need increased clarity and accessibility to the numerous and complicated research conclusions. While there exists research on the benefits of utilizing implementation science techniques and FSPs to better address individual cultures and perspectives, this study revealed exactly what the families could gain from these interventions (Moir, 2018; Smith et al., 2020). The development of FSPs would allow families to obtain and understand university-level research conclusions and be given direction on how this can be applied to their students. Similarly, students would obtain this information, presented at their appropriate level of understanding, and be able to dive into the information at school. With increased clarity and access, the students could then take the research home to their families and allow their home environment to echo what they are learning at school.

An increase in a student’s personal responsibility over the implementation of neurophysiological research and the increase in peer-to-peer communication also broadens aspects of past research. IS techniques suggest that researchers address the culture of their targets using specific strategies which aiming to look at the individual as a whole and approach a study using participatory action research techniques (King et al., 2018; Phillips et al., 2010). Methods such as giving the students the responsibility of selecting research that interests them, digesting the research in a safe school environment, and then bringing the research home would allow for the implementation of the research to naturally target the differences in diverse cultural and
linguistic populations; Students would naturally choose research appropriate for themselves and their families and be able to engage with the research conclusions on a personal level. This would also allow for discussions to occur between researchers and participants, which would allow researchers to identify cultural or linguistic hurdles that occur with specific students and populations. Encouraging peer-to-peer communication when it comes to the introduction of neurophysiological research-strategies would help bridge the gap between school and families, using students as the means of doing so instead of just focusing on what school officials can do. This creates a connection between participatory action research and family-school partnerships, helping to alleviate tensions between parents and teachers using students as the “peers” for both parties (Phillips et al., 2010; Smith et al., 2020). It is students who have viable connections already with their teachers and their families, therefore they would be able to form the most effective network.

**Implications for the Literature**

This study illuminated the benefits of incorporating student action into the implementation of neurophysiological research and outlined what students and parents need from the school to understand and obtain research as well as a notable challenge students face when it comes to implementing research into their own homes. Providing students with personal responsibility over the specific topics of study and allowing them to engage with the material as adolescent adults increases the likelihood of engagement and acceptance of research-based strategies. Having the students bring the material home to their families increases its relevance and allows diverse families to engage with university-level research using peer-to-peer communication. At times, teachers are not seen as peers and may instead be seen as arrogant or from unrelated backgrounds, therefore it is important that the research is placed in the hands of
the students which then allows these strategies to bridge the gap between research and practice (Hannon & O’Donnell, 2022; Soicher et al., 2020). Additionally, this research found that parents and students require the school’s help providing access and clarity when it comes to complex ideas of finding and understanding research-strategies such as the ones presented. This would make the school a place for learning for the community, not just the students. Finally, this study presented the idea that students believe in the existence of a “ghost majority” population who would never take the time to understand or use neurophysiological research-based strategies. This creates a barrier for implementation, where the students, unfortunately, do not think that the research will matter outside of themselves or that the adoption of new policies or strategies needs to occur with a high number of individuals for it to matter to anyone. This challenge should be highlighted and further explored when discussing the necessity of implementing research with high school students.

**Implications for Practice and Policy**

This research can influence practices at the high-school level using teachers and families, adapting whole-school priorities, and with implementing new district policies. Within the classrooms and homes, teachers and parents can begin to promote student relationships with university research and be open to students bringing the research from the classroom and into the home. Schools can benefit from hosting more informal events that allow for the facilitation of teacher-family relationships and the promotion of general information regarding an understanding of specific neurophysiological development patterns for students of each age range. Finally, the school district can install policies when it comes to decisions about learning-from-home, necessary parental supports, teacher-family facilitated relationships, and required parent/guardian participation with the implementation of research.
Teachers and Families

Both teachers and parents can support students' acclimation and accumulation of neurophysiological research. Teachers can build in moments for students to explore university-level research topics of their choice and become more accustomed to what topics are addressed in research and what they can gain from diving in. Additionally, students can be informed on the proper website or locations as to where they can access this type of research and practice disseminating research findings while in class in preparation for taking it home. Families can help support this process by building in time at home when students can bring forth what they have learned and present research to their families. This increases the likelihood for adoption and understanding of the research when the students take personal responsibility over its implementation and the peer-to-peer communication that occurs when members of the community (students) appeal to their own families. Welcoming research daily and taking it home to the community would alleviate student’s apprehensions towards the mythical rejection of research by the “ghost majority.”

Whole-Schools Priorities: Informal Programs

In schools, informal programs should be held for members of the school community regarding neurophysiological research, specific research-based strategies, and information on current developmental patterns for students of different age groups. These programs should maintain a relaxed environment and be held at different times of the day throughout the school year and include a zoom option for parents with busy schedules. The topics should address popular issues such as neurological disorders, sport concussions, attention disorders, sleep deprivation, light’s effects on the brain, social media addiction, drug and alcohol effects on the brain, etc. that are appropriate for high school students. Additional programs would also need to
address methods used to protect the brain, since the majority of students and parents from this study were only aware of how not to hurt the brain instead of how to heal it. These seminars could address mindfulness practices, meditation, exercise and the brain, environmental enrichment, etc. to provide specific interventions to families and students. These discussions would increase both clarity and access for families and provide parents with the tools they need to echo effective research-based strategies that the students are hearing at school. Additionally, this informal atmosphere would provide more sensitive families with the ability to engage with research that may be contradictory to their current lifestyles without feeling judged or lectured. Social gathering events would alleviate tensions and promote community engagement and allow for discussions of the research-strategies in a relaxed state with school administrators and teachers (Costa & Faria, 2017). With the prevalence of Zoom and Google Meets platforms, there can now be meetings at any time of the day, allowing all families to access all school meetings.

**District Policies**

The COVID-19 pandemic and the resultant loss of learning illustrated how ill-prepared students, schools, and families were in promoting and sustaining good neurophysiological behaviors that would encourage the ability for students to learn at home. This study’s findings show that students and parents are unaware of current neurophysiological research-based strategies and do not know how to access research on a regular basis. During the learning-from-home model, families in this school district were not given adequate resources to help their students learn in this alternative environment. Therefore, it should be a future policy for school districts to provide parents with access to formal training and support in understanding neurophysiological research-based strategies that can be easily implemented in the household, especially if students are ever expected to complete their work from home in the future. It is the
researcher’s proposal that districts provide the necessary resources and finances needed to collect research-based data and work towards disseminating it to their families in an accessible way such as with appropriately translated newsletters, simple checklists, and student conducted and presented research. Each year, new resources would need to go out to all families regarding appropriate neurophysiological strategies and information for each specific age group and year.

**Limitations of the Study and Future Research**

Limitations to this study include the diversity of parent participants, the specific population of student participants, the duration of time spent with the participants, and the research topic explored by the participants. These limitations can be addressed through future research. Conducting a similar study with multicultural families, with other forms of research other than neurophysiological, and identifying if students implement the research strategies they have learned during focus group sessions would be useful.

**Limitations of the Study**

One major limitation to this study is the lack of diversity with the participants. Only three parents agreed to be interviewed by the research and all three were white females with post high school degrees. Two of the participants had bachelor’s degrees and one had a graduate degree. This limitation did not allow the researcher to analyze the implementation of research from families who may be completely unfamiliar with neurophysiological research and/or methods used to obtain and analyze university-level research data. Nor did these parents represent the demographic majority or diversity of the school site. Student participants were diverse in ethnicity and language spoken at home, but the researcher was only able to work with students taking a mandatory freshman-level science class on the high school campus.
Another important limitation to discuss was the amount of time the researcher was able to spend with the participants. The student study was held over four weeks and included two days of survey work and four days for the focus groups. The parent study consisted of only a single interview. During student focus groups the researcher was able to return to previous topics and use respondent validation techniques to ensure proper understanding of the findings, however the researcher was only able to do this during a single session with parents and not during future meetings (Creswell & Creswell, 2018). Time also limited the type of research that the participants could engage with during discussions. Due to this limitation and the researcher’s positionality, the study focused on the implementation of neurophysiological research only.

**Future Research**

To continue to explore this topic, future research will need to be conducted. This study was able to look at the perspectives of involved and willing parent participants who already had some experience with university-level research. Even with this experience, however, the parents still recommended that the school become involved in the implementation of research-based strategies with their students. It would be important for future studies to obtain perspectives from parents and families who do not have a university background and who are currently experiencing careers not obtained using an undergraduate or graduate degree. Perhaps the importance of implementing strategies would not be as important for this population due to their unfamiliarity with the topics, or perhaps it would be even more important due to their unfamiliarity.

It would also be important to explore other research topics other than neurophysiological and extend the study past the presentation and discussion of the research. This type of research has direct impacts on adolescent wellbeing and can be applied outside of the school setting,
however, it is not as easily understood as other possible research topics. To truly understand why neurophysiological research strategies are effective, one would need to understand simple brain science, and this can be highly limiting and perplexing to certain individuals. Therefore, to look further into how research can be implemented in high school populations, it would be beneficial to also address other types of research that may be more approachable to high school students and families such as mental health strategies based on music and financial strategies for adulthood. Additionally, there should be future research conducted after presenting students with information regarding research-based strategies to see if they were able to translate the strategies into their lives outside of the classroom and how likely they were to share these findings with their families. Finally, conducting this study with a larger population, with a greater diversity of schools, and longitudinally from kindergarten through high school would further our understanding of the implementation of neurophysiological research among students.

**Conclusion**

This study identified the student and parent perspectives on best implementation practices for neurophysiological research among high school student populations. The impacts of this research include a highlighting of the benefits of utilizing student personal responsibility and their ability to become peers for both the school and family communities. Additionally, the findings outlined necessities and challenges that exist for both students and parents concerning the accumulation of research-based strategies and the ease to which this can be implemented into sensitive environments. These findings formulated implications for teachers, families and school policies centered around making the research readily available and accessible to all in the community. It is the researcher’s recommendation that students are given the opportunity to be responsible for researching and presenting neurophysiological strategies both at school and at
home. Additionally, both teachers and families need to make time for students to bring the interventions into the larger community and even present to community members during both formal and informal meetings hosted by the school district.
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Appendix A

Student Prep-Survey Questions
Name ______________________

Ethnicity (Circle one): Black or African American (non-Hispanic), Hispanic, Pacific Islander or Native Hawaiian, Asian, White (non-Hispanic), American Indian or Alaskan Native

Highest level of education from parent/guardian #1 ___________________

Highest level of education from parent/guardian #2 ___________________

Number of working adults in household ___________

Answer the following questions using a scale from 1 - 4 based on the following standards: 1 - none/not ever, 2 - sometimes, 3 - often, 4 - totally agree/always.

1. Your academic learning strategies are well-connected to current scientific research.

2. You are familiar with current research behind how your brain learns during adolescent (teenage) years.

3. Your daily actions encourage your ability to learn in school.

4. You adapt your daily actions based on current research behind how your brain learns during adolescent (teenage) years.

5. You would be willing to make changes to your home environment based on current research about adolescent brain development.

6. It is important to seek out and follow current research on adolescent brain development.

7. It is easy for you to find current research on adolescent brain development.

8. You have learned about how the brain develops at school.

9. You have a lot of books in your household.

10. You have learned about how the brain develops outside of school.

11. Your daily actions have a major impact on your ability to learn in school.

12. The school should be responsible for providing students with information on adolescent brain development.

13. Current research from universities is related to your life.

14. Most research from universities can be applied to your life.

15. It is easy for your family to obtain and read current research about adolescent development.

16. Items in one’s home can help encourage learning in school.
17. The school should have parents attend meetings about adolescent brain development and learning.

18. The school should have students attend meetings about adolescent development and learning.

19. A student’s environment outside of school can affect their brain development and learning capability.

20. Once one injures their brain, the sections or pathways cannot be healed.

21. You know and understand key concepts about how your adolescent brain is developing.
Appendix B

Student Focus Group Questions
Topic 1: The Neural Pathways Behind Learning

Subtopics:
1. Brain Structures
2. Neurons
3. Neurotransmitters and the Reward System
4. Brain Development during Adolescence
5. The Brain and Learning

Main Questions
1. What do you already know about brain development in the teenage years? (Before lecture)
2. Who needs to know this information?
3. What can we do with this information?
4. Was there anything presented that you already know about?

Topic 2: Manipulating Neural Pathways

Subtopics
1. Light
2. Sleep
3. Attention

Questions
1. What do you currently do to make sure that your brain is ready to learn? (Before lecture)
2. Is there anything from this research that you already integrate into your life?
3. Have you heard any of this information before?
4. How can we relay this information to all families with teenage children in the San Rafael community?
5. What issues are there to integrating this research?
6. Does the research seem relevant to you or your peers?
Topic 3: Damaged Pathways

**Subtopics**

1. What can happen to brains and their neural pathways?
2. What causes the damage?

**Questions**

1. Can the brain be damaged by what we do in our everyday lives? (Before lecture)
2. After seeing this research, do you believe the brain can be damaged by external choices?
3. Who needs to know this information?
4. Do you think the teenage years are especially important when it comes to the brain’s pathways?
5. Whose job is it to protect the teenage brain?
6. Have you heard any of this information before?
7. Have you ever thought about how you take care of your neural pathways before?

Topic 4: Healing Pathways

**Subtopics**

1. Exercise
2. Environmental Enrichment

**Questions**

1. How does one promote brain growth and development? (Before lecture)
2. Do you participate in any of the healing activities presented in the research?
3. How do we begin to encourage these changes for people?
4. Should the changes take place at home or at school?

If we could only implement the changes in one place, which would be the most effective for a person, at school or at home?
Appendix C

Student Post-Survey Questions
Name _______________________

Answer the following questions using a scale from 1 - 4 based on the following standards: 1 - not at all/not ever, 2 - sometimes, 3 - often, 4 - totally agree/always.

1. I now know more about adolescent brain development than I did before.
2. I am the main individual responsible for the development of my neural pathways.
3. Parents are the main individuals responsible for the development of my neural pathways.
4. School officials are the main individuals responsible for the development of my neural pathways.
5. The brain can be healed after damage is done.
6. The teenage years are extremely important for brain development.
7. Parents should stay involved in their teenagers' lives in a way that encourages brain development.
8. Small changes to one’s daily schedule can impact their brain development.
9. University research is relevant to my life.
10. Relevant research is easy to find and understand.
11. I want to integrate this research into my daily life if I can.
12. I feel confident that I can integrate some portions of this research into my daily life.
13. I hope to use research to help the brains of others in the future.
14. It will be easy for my family to integrate this research into our household.
15. My family will want to integrate this research into our household.
16. This research is relevant to someone’s life despite their cultural background.
17. It is important to implement this research earlier rather than later.
Appendix D

Parent Survey Questions
Name _______________________

Ethnicity (Circle one): Black or African American (non-Hispanic), Hispanic, Pacific Islander or Native Hawaiian, Asian, White (non-Hispanic), American Indian or Alaskan Native

Highest level of education from parent/guardian #1 __________________________

Highest level of education from parent/guardian #2 __________________________

Number of working adults in household ___________

Answer the following questions using a scale from 1 - 4 based on the following standards:

1 - none/not ever, 2 - sometimes, 3 - often, 4 - totally agree/always.

1. Your child’s academic learning strategies are well-connected to current scientific research.
2. You are familiar with current research behind how your child’s brain learns during adolescent (teenage) years.
3. Your child’s daily actions in the morning encourage their ability to learn in school.
4. Your child’s daily actions in the evening encourage their ability to learn in school.
5. A teenager should adapt their daily actions based on current research behind how their brain learns during adolescent (teenage) years.
6. You would be willing to make changes to the household if suggested by current research about adolescent brain development and learning.
7. It is important to seek out and follow current research on adolescent brain development while you have children in those years.
8. It is easy for you to find current research on adolescent brain development.
9. You have a lot of books in your household.
10. You have learned about how the brain develops at some point in your life.
11. Your child’s everyday actions outside of school affect their POTENTIAL to learn in the classroom.
12. The school should be responsible for providing STUDENTS with information on adolescent brain development.
13. The school should be responsible for providing PARENTS with information on adolescent brain development.
14. Most research from universities can be applied to your child’s life and seems relevant.
15. It is easy for your family to obtain and read current research about adolescent development.

16. Items in one’s home can help encourage learning in school.

17. The school should have PARENTS attend meetings about adolescent brain development and learning.

18. The school should have STUDENTS attend meetings about adolescent development and learning.

19. A student’s environment outside of school can affect their brain development and learning capability.

20. It is easy for you to assist your child with their schoolwork.

Nombre __________________________

Etnia (Marque uno): Negro o Afroamericano (no-hispano), Hispano, Pacífico o Hawaiano, asiático, Blanco (no-hispano), Indio americano o nativo de Alaska

Nivel más alto de educación por parte del padre / tutor # 1 __________________________

Nivel más alto de educación por parte del padre / tutor # 2 __________________________

Número de adultos que trabajan en el hogar __________________________

1. Las estrategias de aprendizaje académico de su hijo están bien conectadas con la investigación científica actual.

2. Está familiarizado con las investigaciones actuales sobre cómo aprende el cerebro de su hijo durante la adolescencia.

3. Las acciones diarias de su hijo en la mañana fomentan su capacidad para aprender en la escuela.

4. Las acciones diarias de su hijo por la noche fomentan su capacidad para aprender en la escuela.

5. Un adolescente debe adaptar sus acciones diarias basándose en la investigación actual sobre cómo aprende su cerebro durante la adolescencia.

6. Estaría dispuesto a hacer cambios en el hogar si lo sugiere la investigación actual sobre el desarrollo y el aprendizaje del cerebro de los adolescentes.

7. Es importante buscar y seguir las investigaciones actuales sobre el desarrollo del cerebro de los adolescentes mientras tengan hijos en esos años.
8. Es fácil para usted encontrar investigaciones actuales sobre el desarrollo del cerebro de los adolescentes.


10. Ha aprendido cómo se desarrolla el cerebro en algún momento de su vida.

11. Las acciones diarias de su hijo fuera de la escuela afectan su POTENCIAL para aprender en el aula.

12. La escuela debe ser responsable de proporcionar a los ESTUDIANTES información sobre el desarrollo del cerebro de los adolescentes.

13. La escuela debe ser responsable de proporcionar a los PADRES información sobre el desarrollo del cerebro de los adolescentes.

14. La mayoría de las investigaciones de las universidades se pueden aplicar a la vida de su hijo y parecen relevantes.

15. Es fácil para su familia obtener y leer investigaciones actuales sobre el desarrollo de los adolescentes.

16. Los artículos en el hogar pueden ayudar a fomentar el aprendizaje en la escuela.

17. La escuela debe hacer que los PADRES asistan a reuniones sobre el desarrollo y el aprendizaje del cerebro de los estudiantes.

18. La escuela debe hacer que los ESTUDIANTES asistan a reuniones sobre el desarrollo y el aprendizaje del cerebro de los estudiantes.

19. El entorno de un estudiante fuera de la escuela puede afectar su desarrollo cerebral y su capacidad de aprendizaje.

20. Es fácil para usted ayudar a su hijo con su trabajo escolar.
Appendix E

Parent Interview Questions
1. What about this research did you already know?
2. How do you feel about this research?
3. Would you be willing to integrate any of these measures in your child’s life if provided with the research?
4. Does this research seem relevant to your life or your child’s life?
5. What would prohibit you from being able to implement any of these strategies suggested in the current research brain development?
6. Do you believe the home environment or the school environment matters more or less for a student’s academic success?
7. In what ways does your student find support for their academic success (either at home, school or elsewhere)?

1. ¿Qué de esta investigación ya conocías?
2. ¿Qué opinas de esta investigación?
3. ¿Estaría dispuesto a integrar alguna de estas medidas en la vida de su hijo si se le proporcionará la investigación?
4. ¿Esta investigación parece relevante para su vida o la de su hijo?
5. ¿Qué le prohibiría poder implementar cualquiera de estas estrategias sugeridas en la investigación actual sobre el desarrollo del cerebro?
6. ¿Cree que el entorno del hogar o el entorno escolar es más o menos importante para el éxito académico de un estudiante?
7. ¿De qué manera su estudiante encuentra apoyo para su éxito académico (ya sea en casa, en la escuela o en otro lugar)?