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A Neuroscience-Based Curriculum for Addiction Prevention For Fourth-Grade Students

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A NEUROSCIENCE-BASED CURRICULUM FOR ADDICTION PREVENTION FOR FOURTH-GRADE STUDENTS

by

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THESIS

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DEDICATION

I will always be indebted to my parents, Teodoro and Martha. Thank you for encouraging me to go higher in my profession and academic endeavors. I want to thank my husband, Diego, and our six children, who supported me in achieving this master's degree. I hope my learning helps all of them in many ways. I appreciate their patience and generosity with their time, especially Teresita and Valentina, who helped me with the home connection activity and reassured me that children can learn neuroscience easily.

As a social work student, I wanted to make a social justice impact on children, one of the most vulnerable populations. For this reason, I dedicate this thesis to all the children and the youth of the world, especially those who, due to their substance abuse, have been rejected from schools, incarcerated, or involved in a fatal substance abuse-related accident in which innocent lives have been taken.

ABSTRACT

A NEUROSCIENCE-BASED CURRICULUM FOR ADDICTION PREVENTION FOR FOURTH-GRADE STUDENTS

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Substance use is one of the main problems affecting adolescents and young adults. While the consumption of alcohol has decreased, the consumption of marijuana has increased rampantly due to youth's positive perception after being legalized in 24 states with no clear message of the many adverse effects this drug causes. Different approaches to prevention have been used throughout the years: scare-led tactics, socio-emotional learning skills, and neuroscience-based curriculums. Since substance use results from the conjunction of different biopsychosocial factors that lead to this relapsing brain disease, the solution should integrate different preventive solutions as well. Public policy, schools, social workers, and society in general should work towards a more positive approach towards substance use prevention. The stigma associated with substance use does not help to overcome the problem—neither exclusionary policy nor incarceration. Policies and budget spending should be higher in prevention than in treatment. Children should learn basic knowledge about the brain as the most essential part of the body. A comprehensive approach that includes a gradual delivery of factual knowledge derived from the neuroscience of addiction is pivotal from an early age to acquiring a positive and grateful relationship with the brain. This thesis provides a curriculum

model focusing on the reward system as an example of how teachers can explain neuroscience concepts around addiction in an appropriate language for fourth-grade students. The introduction of basic neuroscience concepts can help children achieve healthier lives. The two theoretical frameworks supporting this curriculum development are strength-based perspective and mindfulness practices. The strength-based perspective is used because the brain is a hidden strength for children, and mindfulness is used because recent studies show that mindfulness practices develop mindful traits that help to integrate and regulate brain function.

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A Neuroscience-Based Curriculum Model for Addiction Prevention for Fourth-Grade Students

As society moves in time, substance use disorders in minors have increased. There are new delivery systems for drugs, such as e-cigarettes, vape pens, and gummies, that facilitate their access (Meredith et al., 2021). According to the National Center for Drug Abuse Statistics (NCDAS), Government spending on drug abuse treatment and prevention shows this trend; in 2008, the government spent $6.7 billion on treatment compared to $15.5 billion in 2020 (National Center for Drug Abuse Statistics, 2023), more than double in a lapse of eleven years. However, the spending increment on prevention has been lower than on treatment; in 2008, the government spent $1.8 billion on prevention compared to $6.7 billion on treatment (NCDAS, 2023). In 2020, it spent $2.1 billion on prevention compared to $15.5 billion on treatment (National Center for Drug Abuse Statistics, 2023). The difference between the money spent on treatments and prevention is enormous. This difference is significant to highlight because prevention is critical to avoid future spending on treatments that would not be necessary as the problem would not grow in the same intensity. Prevention of early onset of addiction is crucial because its eradication becomes difficult because of "substance addiction as a chronic relapsing brain disease" (Volkow & Li, 2005). The overdose epidemic presses the government to act through public policy, research, and spending (US Department of Health and Human Services, 2023).

In 2013, the Diagnos*tic Statistical Manual of Mental Health Disorders* (5th ed.; DSM-5; American Psychiatric Association, 2013), encompassed 10 substance-related disorders, primarily illicit drugs. According to the National Survey on Drugs Level done by the Substance Abuse and Mental Health Services Administration (SAMHSA), in 2021, 61.2 million people aged 12 and older, and young adults used illicit drugs (U.S. Government of Health and Human Services, 2023). Marijuana is at the top of consumption, with 52.5 million

people using it (U.S. Government of Health and Human Services, 2023). Even though recreational marijuana has been legalized in 24 states (DISA, 2024), it is still illegal for people under the age of 22. Unfortunately, legalization has contributed to the belief in the youth that marijuana is harmless (American College of Pediatricians, 2018).

This thesis will provide a literature synopsis of the different addiction prevention curricula and their outcomes. It will focus on the neuroscience of addiction and how this can be taught in a curriculum for children in elementary schools. It provides a model example of a neuroscience-based fourth-grade curriculum based on research on evidence-based addiction prevention programs. The core message of the model example is to teach elementary children to love their brains. This positive approach could add a solid defense barrier against risk factors children will encounter as they develop. Most research affirms that adolescence is a critical time for drug addiction prevention because of the neurodevelopmental immaturity of the adolescent brain (Jensen, 2015). Precisely for this reason, this thesis proposes that prevention strategies cannot wait until the teenage years to talk about the risks associated with addiction.

Adolescence is a developmental stage where opposition to rational thinking and adult instruction is widespread due to the lack of development of the prefrontal cortex (Jensen, 2015). Therefore, to explain to an adolescent the negative implications of addiction to the brain's reward system is going to be harder to accept, especially when there is so much peer social-environmental influence on using drugs (i.e., marijuana has a harmless perception) (Jensen, 2015). Babinski et al. (2018) suggested that "integrating a dual-process model that considers adolescent's emotional reactivity in addition to their analytic decision-making processes may strengthen the curricular approach" (Babinski et al., 2018, p. 495).

In 2020, Dr. Karl Hill and colleagues from the University of Colorado Boulder and the University of Washington did a study, the first of its kind, that looked at the effects of the program Raising Healthy Children (RHC) on elementary school children in 1980 and the 22 subsequent years (Karl Hill et al., 2020). The authors concluded that early preventive interventions where parents, community, and children are involved in the instruction were associated with positive behavior, including resistance to drug use, in children growing up and their own future children (Karl Hill et al., 2020).

Nurses Hall-Long and Dishop conducted a pilot first- and third-grade drug education program and concluded, "Drug education classes should be offered every year for parents and youth, kindergarten through twelfth grade" (Hall-Long & Dishop, 1999, p. 34). According to this study, it takes the whole community to be involved in the program; parents especially need to receive psychoeducation as children role model their drinking or drug use behavior as a coping mechanism (Hall-Long & Dishop,1999).

In 2018, talking about substance use prevention, Beth Mattey, the president of the National Association of School Nurses, stated, "It only makes sense to start health education in the early grades. The students will build on the knowledge as they grow and learn" (National Education Association, 2018, p. 2). From an early age, children need to know that the body part that controls their actions is called the brain, and its many functions are so crucial that it is critical to take care of it. Prevention in the early stages of life would be focused on the knowledge of the good things the brain does to the body. The main objective is to build a positive and grateful relationship with the brain. This positive relationship will become a protective factor against addiction of any kind. Suppose children do not understand the value of their brains for their lives. In that case, it will be easy to fall into addiction and many other unhealthy behaviors further down the road. Child behavior expert Chrissie Davies

states that the most essential parenting tool is to teach children how to keep their brains happy and healthy (Kiddo, 2020). This concept is supported by the strength-based perspective in social work, in which interventions are based on the resources and strengths that clients already possess (Simmons et al., 2022). In this case, the brain is a strength that children cannot only learn about its function but also learn to be aware of the capacity to shape it for better performance and general well-being.

Literature Synopsis

a. Substance Use Prevention Programs

Different drug addiction prevention programs have been in schools since 1980 in the United States (Drug Abuse Resistance Education, 2023). The introduction of the Safe and Drug-Free School Community Act (SDFSCA) in 1986 made it compulsory for schools to implement substance use prevention programs (University of Laverne, 2023). The SDFSCA has been modified several times, and in 2002, it required schools to use evidence-based prevention programs to avoid failure and wasting public funds (Kumar et al., 2013). However, only a few schools complied with the requirement of having an evidence-based prevention curriculum. On the contrary, schools developed or outsourced their curriculums; only in 2013, there were 200 commercial addiction prevention programs to choose from (Kumar et al., 2013).

Many of these programs have used scare and police-led tactics with coercive consequences that did not educate children or help advance prevention strategies (Machado et al., 2022; Meredith et al., 2021). Examples of these types of programs are the Drug Abuse Resistance Education (DARE) or Just Say No programs, which did not prove to be effective (Debenham et al., 2022; Meredith et al., 2021). Results of the DARE program did not show a significant difference in attitude toward substance use between the students who received the program and those who did not participate (Belcher & Shinitzky, 1998).

Later, addiction prevention programs started teaching students socio-emotional learning skills (SEL) to help them increase self-esteem, resolve conflicts, focus on personal goals, lower anxiety, and stress, and self-regulate and avoid risky behaviors (Texas Education Agency, 2023). SEL is part of a broader program in schools that belong to a healthy school climate called the Multi-tiered System of Supports (MTSS), which provides three levels of interventions (universal, students at risk, and selected students) (Mental Health Policy Institute, 2018). SEL curricula are central to universal intervention, which all students can access through a supportive learning environment, behavioral health screening, and referral process (Mental Health Policy Institute, 2018). The teaching and modeling of SEL skills are protective factors against addiction. In 2008, the Substance Abuse and Mental Health Services (SAMHSA) accredited three evidence-based programs focused on socio-emotional skills: All-Stars, Keepin' it REAL, and LifeSkills Training (Pettigrew & Hecht, 2015). Sachin Kamble (2023) from the Texas Health and Human Services, explained in an online seminar that historically substance use programs in schools have been focused on:

Emphasizing the importance of making good choices;

teaching youth refusal skills, positive coping skills, and self-efficacy;

teaching parents how to talk to their kids about drugs and alcohol;

presenting the harms of drugs and alcohol use; and

encouraging pro-social norms around drugs and alcohol (Kamble, 2023, 14.19).

A systematic review of these socially influential approaches found that children and older adolescents benefited from these interventions (Debenham et al., 2022). Currently, in Texas, the evidence-based program of SEL being implemented in the districts is PAXGBG, which stands for Pax Good Behavior Game (Texas Education Agency, 2024). SAMHSA funds PAXGBG free training to the MTSS and the public (Texas Education Agency, 2024). This includes initiatives integrating the family by bringing speakers to the school to talk to

the parents about how to protect and monitor their children from substance use (Texas Education Agency, 2024). Also, workshops for parents about essential communication skills, parenting tips, and resources to cope with trauma, stress, and anxiety (Texas Education Agency, 2024). This strategy goes in hand with research that stresses the importance of family and community involvement in the prevention program (National Institute of Drug Abuse, 2021; Machado et al., 2022), like the RHC program, which involved parents, teachers, and the community and positively impacted even in subsequent generations. The development of substance use has a multidimensional component that includes individual, family, social, and structural factors (National Institute of Drug Abuse, 2014, March 31). Therefore, including family and community involvement will lead to better outcomes in prevention. Ventura & Bagley (2017) go a step further, stating that the drug use disorder crisis is also linked to the fact that the actual healthcare system underutilizes the positive impact that the engagement of family members can bring to preventive and recovery strategies (Ventura & Bagley, 2017).

Recent studies are looking into new strategies for addiction prevention in schools. Some of them have concluded that the approach to addiction prevention needs to give more emphasis on neuroscience rather than the negative social and moral consequences of addiction (Canadian Centre of Substance Abuse, 2016; Machado et al., 2022; Meredith et al., 2021). The Canadian Centre of Substance Abuse (2016) explains that:

> Proponents of these programs propose that by increasing youths' knowledge about the adverse neurological and health effects of drugs, youth will be empowered to make their own appraisals about the effects of drugs, and will subsequently make informed decisions about substance use in their own lives, ultimately resulting in deleted or decreased use of substances. (Canadian Centre on Substance Abuse, 2016, p. 2).

One of the significant differences between a neuroscience-based curriculum for drug prevention and the other curriculums is that it explicitly tells how and why the brain is affected by drug use (Canadian Centre on Substance Abuse, 2016). Since 1990, knowledge about the brain has increased steadily (Altimus et al., 2020; Jones & Mendel,1999), which has helped to develop neuroscience-based substance use prevention curricula and recently, with the help of technology, there have been more interactive resources for students to understand complex neuroscience concepts (Society for Neuroscience, 2017). Neuroscience knowledge is adequate to prevent drug addiction and nurture cognitive and emotional skills (Machado et al., 2022). This is because knowing about the brain and relating to it consciously helps people be aware of themselves, their actions, thoughts, and feelings (Siegel, 2023). At this point, mindfulness techniques become an essential tool to be added to the curriculum. Mindfulness is very much connected to the awareness of brain function, and enough evidence proves that mindfulness practices shape the brain (Siegel, 2023). It activates neuroplasticity and becomes pivotal for general wellness (Holmes, 2018).

One of the neuroscience-based prevention programs that has shown effectiveness is the Just Say Know program (Meredith et al., 2021), whose objective is to increase knowledge of the neuroscience of addiction in an interactive one-hour session for middle and high school students. The core concepts taught are the brain function, reward system, neurotransmitters in the brain, negative consequences of the behavior of using drugs, and the vulnerability of the adolescent brain. Pre-test and post-test intervention of the program showed that students acquired factual information about the neuroscience of addiction, decreased the percentage of positive perception towards the use of drugs, and finally, those that had friends using were the students that had more difficulty in assuring non-substance use future behavior (Meredith, 2021). These results show again the importance of the social component in addiction prevention programs.

Another neuroscience-based program in the United States is The Brain: Understanding Neurobiology through the Study of Addiction. Harris et al. (2013) studied this program's effectiveness and concluded that the results were positive. The program was directed to adolescents, showing that students acquire more knowledge about brain function and risks associated with substance use, compared to control students, students who participated in the program reduced their consumption of substances. The study supports the idea that a neuroscience-based curriculum will help prevent addiction (Harris et al., 2013). The same results were found in Brain Power! a neuroscience-based preventive program funded by the National Institute on Drug Abuse (NIDA) in the United States (Canadian Centre on Substance Abuse, 2016). This type of intervention demonstrates a connection between knowledge about the brain and subsequent acquisition of healthy behaviors, such as healthy eating, good sleep, exercise, and avoiding drug use (Babinski et al., 2018).

In Australia, a program that proved to be effective is the Illicit Project, a neuroscience-based harm reduction program for older adolescents (Debenham et al., 2022). The framework of the Illicit project is founded on meta-analyses of prevention programs that show that adolescents already using substances will reduce consumption and frequency. This means that adolescents will not abstain from using substances completely, so the emphasis is to reduce the harm caused by substances (Debenham et al., 2022). The program also includes resistance skill training and keeping a healthy brain during the critical years of adolescence (Debenham et al., 2022). In a study done on Canadian youth, it was revealed that perception of harm reduction strategies was more effective than abstinence and that factual, detailed information on the brain was more credible by the youth than fear-based messages against drug use (Canadian Centre on Substance Abuse, 2016).

The studies conclude that addiction prevention must have a multidimensional component that includes the psychological, neurobiological, and social-influence aspects in

the development of children and adolescents (Canadian Centre on Substance Abuse, 2016). Neuroscience-based content tied to interpersonal and intrapersonal skills has more positive results (Meredith et al., 2021). For 12th-grade students, harm reduction strategies have proved more effective (Meredith et al., 2021; Debenham et al., 2022). Substance use is a complex problem, so complex solutions that intersect all aspects that affect the students must be developed. This thesis focuses on one of those aspects: the neuroscience of addiction, taking fourth-grade students as a model example.

b. Gaps in the Literature

Although research has been trying to evaluate the outcomes of neuroscience-based curricula to prevent addiction, there are limitations to follow-up in the long run if students become addicted in college after receiving neuroscience-based instructional preventive information in grade school. Therefore, there is insufficient evaluation of neuroscience-based addiction prevention programs to conclude that negative behavior and attitude toward addiction will be maintained (Canadian Centre on Substance Abuse, 2016). This is a massive gap because research has shown that late adolescence tends to be an escalation period for drug use due to the stressful transition to college, and there is a 30% likelihood of drug use in adulthood if initiated during adolescence (Debenham et al., 2022) (See Appendix A and B to compare historic trends of alcohol and marijuana from 12th grade students and first years of college). Therefore, neuroscience addiction prevention and treatment should be available for students while in college. Napier (2018) states that it is critical for undergraduate students, especially if they are studying careers in biomedical fields, to have a neuroscience-based curriculum to help the public change the stigma associated with addiction and create awareness of the health and social problems that addiction brings (Napier, 2018). Colleges and Universities are bound to the Drug-Free Schools and Campuses Act, which funds Institutions of Higher Education (IHE) to prevent the use of Alcohol and Other Drugs (AOD)

while on campus and gives a standard of conduct and sanctions (U.S. Department of Education, 2006). The Act requires that IHE notify the prevention, counseling, and treatment programs that the institution is offering to faculty, staff, and students (U.S. Department of Education, 2006). The 2021 Annual Report of the Center for Collegiate Mental Health (CCMH), which involves 650 university and college counseling centers, reported that 20% of students received treatment for alcohol or drug use in the year 2020, and 25.3% of students used marijuana in the last two weeks (Center for Collegiate Mental Health, 2022). The report also shows that there has been a steady increase in the number of mental health practitioners allocated to colleges and universities. However, the service capacity is still behind the increasing demand for mental health services (CCMH, 2022). This data suggests that all efforts contributing to substance addiction prevention are worth the effort. This includes basic classes on addiction neurobiology since elementary school.

Additionally, there is a gap between neuroscience-based addiction prevention education given to children from elementary and middle school and high school. Some studies suggested that talking to children about drug addiction has the risk of leading children out of curiosity towards addiction, having the opposite effect of what the goal was in the first place (Technology.org, 2014). Mental health programs in elementary school have focused more on teaching social-emotional skills, like self-control and stress management, which are central. Not having the proper skills to manage stress is likely the root of many physical, emotional, and mental problems (Seaward, 2022). There is enough evidence that stress is a risk factor for substance use. However, to succeed in implementing addiction prevention, accurate knowledge of neuroscience will help connect what stress does to the body, especially the brain. The strategy of suddenly teaching the adverse effects of addiction in middle schools and its punishments and consequences is not a gradual delivery and complete picture of neuroscience knowledge connection with healthy habits.

In a pilot study, Babinski et al. (2018) conducted interviews with teachers after implementing a neuroscience-based curriculum for high schoolers, and teachers expressed that the content was dense for first-year high school students and that it was a challenge for them to teach the subject (Babinski, 2018). There is a need for appropriate curriculum content and language use for every grade (Machado, 2022). Fun interactive activities, hands-on materials with the parts of the brain, and crafts designs such as Montessori-style teaching could be an excellent resource for learning for children. Also, teachers should be trained in neuroscience to avoid more required time for instruction. This can be done by integrating the neuroscience material into the existing curricula because schools are usually packed with busy schedules (Meredith, 2021). Giving priority to a neuroscience-based curriculum will provide children with healthier lives, which is a critical education component. The knowledge of neuroscience can be applied by each student in his personal life, i.e., knowing that stress makes an organ of the brain called the amygdala go into a fight-or-flight response can make the person aware of how to respond better if, at the same time, the person has been taught that mindfulness helps reduce the outburst. This connection between learning and emotional knowledge can be transferred from one experience to another in real-time life events (Purdy & Morrison, 2009).

Lastly, it is suggested to be more instruction for high school addiction prevention programs. There is a need for having young people engaged as participant leaders in the program (Canadian Centre on Substance Abuse, 2016). During adolescence, peers influence each other negatively or positively (National Institutes of Health, 2021); building team groups of young people who have taken the message that having healthy brains will lead to a happier future could be pivotal for the development of the program (Machado et al., 2022). Youth leaders who can help ingrain the neuroscience program's message to their peers become a protective factor to resist peer pressure to use drugs or other unhealthy behavior. It

is recommended that middle and high school students could also help teach the program to elementary schools, supporting the classroom teachers with hands-on activities. This could become a preventive strategy between schools. Complementary outside resources, such as speakers and interactive neuroscience museums, could add to the learning experience.

Research Objective

To develop a neuroscience-based curriculum for addiction prevention for fourth-grade students.

Curriculum Development Strategy

A literature synopsis was used to gather information about evidence-based curricula for addiction prevention for children and adolescents in school. More specifically, the search was focused on finding neuroscience-based curriculum programs. The information was found using the following databases: ERIC, Research Gate, Google Scholar, the National Institute on Drug Abuse (NIDA) research database, UTA (University of Texas at Arlington) Library, and various centers of addiction prevention. The criteria were to gather information from 2013- to the present year. Historic or older studies focused on predictability content were exempt from the requirements because this helped to have a retro-perspective approach to the evolution of the programs or addictions throughout the years. The information gathered led to the analysis of some gaps that must be filled to construct a systematic and gradual neuroscience-based curriculum that serves as a protective factor in preventing addictions and improves the general well-being of elementary students in schools. The theories undergirding the curriculum are (1) the strength-based perspective because this curriculum emphasizes that the brain is a strength and the most potent part of the body and (2) Mindfulness-based approaches because the curriculum aims to teach the children mindfulness practice to strengthen their reward system to achieve emotional regulation, sound decision-making, resilience, and kindness toward themselves and others. These socio-emotional skills need to

be part of a comprehensive curriculum development. Strength-based perspective and mindfulness-based approaches will help the students strengthen their self-care and self-esteem, a protective barrier against socio-environmental negative risk factors.

Theoretical Framework for the Curriculum Model

a. Strength-Based Perspective

The Strength-Based Perspective is very much at the core of social work. It can be defined as "using a person's strengths and assets to assist problem resolution" (Galloway et al., 2020, p. 32). Galloway et al., (2020) explain that the strength-based perspective has also a well-being target approach, as the outcomes result in improved motivation, academic achievement, positive coping, and learning engagement. Consequently, the authors concluded that the strength-based perspective has some benefits, such as preventing self-harm and low self-esteem because it centers well-being at the center of the individual's goals. These authors state that identifying children's strengths at a young age is helpful because they can expand into other strengths-related areas, especially if that strength is reinforced frequently throughout the years; "nurturing strengths in children may have profound long-term gains" (Galloway et al., 2020, p. 32).

Applying this theoretical framework to this paper, children must identify their brains as one of their strengths and work on their potential from an early age. Through knowledge about the brain, children are empowered and learn self-determination around self-care. Empowerment, self-determination, and person-in-environment are essential components of the strength-based perspective (Simmons et al., 2022), and teaching children to be aware of their brain's capacity empowers them to make healthier decisions throughout their lives. This is what Bandura defined as "self-efficacy," "beliefs in one's capabilities to organize and execute the courses of action required to manage prospective situations" (Galloway et al., 2020, p. 42). Children learn to use self-efficacy in their decision-making process to

differentiate between bad and healthy choices because they are learning the science behind it and because there is a connection between that learning and daily life experience, i.e., creating a mindful eating mindset. The repetitive learning practice throughout the many years of school reinforces these capabilities. Children should be expected to speak about simple neuroscience concepts in an ideal environment that nurtures them with basic knowledge of the mind-body relationship. The awareness of the mind-body connection enhances the learning process and teachers should be conscious of this interconnection to bring best results in the classrooms (Holmes, 2019). The *Mindful Schools* and *MindUp* curriculum have already started to develop this strategy.

Moreover, interventions in a school setting have a social impact that incentivizes constructive collaboration within the students as they can learn about the brain together (Saleeby,1996) Children in a school are in an environment where one affects the other. One of the most effective evidence-based interventions in schools is psychoeducation (Mertens, 2020). Saleeby (1996) explains that communities grow together by learning together around healthy goals (Saleeby, 1996). Learning neuroscience together strengthens the capacity to build mutually healthy goals. Instead of giving a message of "do not do that," the message is "I/we love my/our brain, I/we take care of it because it makes me/us powerful." Each peer and each student are a source of strength to the other (Saleeby, 1996). Knowing, for example, how mindfulness practice helps to overcome stress and what is going on in your brain can make each student a guardian for the mental health of the other. It is helpful for people to have reminders about healthier ways to overcome demanding situations. The strength-based approach builds up developmental resilience (Saleeby, 1996). Instead of approaching the developmental challenges of growing up into adolescence with fear or fatalistic pathology, it moves towards a healthy mindset. Scott Giacomucci (2021) gives an extensive list of authors

that uphold the strength-based perspective to bring hope, resilience, opportunities, and capacity to change a trajectory that might look hopeless (Giacomucci, 2021).

Regarding the body, Saleeby (1996) writes, "In a sense, the strengths perspective itself begins with appreciating the body and its tremendous restorative powers as well as its powers to resist disease" (Saleeby, 1996. p. 300). The brain is one of these parts waiting to be developed through a rich environment that provides the activation of yet unexpressed neurons. This neurological development is enhanced by the collective learning in the school. The inherent capacity of the brain to change through neuroplasticity gives enormous hope to children that they can create new pathways and that they are the authors of their lives. As Saleeby beautifully expresses, "To believe in the naturally selected hardiness and wisdom of the body is to believe in the possibility of any individual or group surmounting difficulty" (Saleeby, 1996, p. 301).

The strength-based perspective elevates self-esteem, the main focus is on what the person has and not on what is lacking. It provokes a positive emotional state that promotes general well-being, strengthening the immune system, psychological state, and interpersonal relationships (Saleeby, 1996). This is what Mills (1995) called The Health Realization Community Empowerment Model, in which educating people and leading them to recognize their strengths will make them achieve common goals (Saleeby, 1996). Again, one of those strengths is the inner health that individuals can bring with the body's innate power to heal itself and then teach other community members to do the same (Saleeby, 1996). This is precisely what this thesis is promoting, prevention through neuroscience knowledge on the capacity of each individual to self-regulate their brain. There is no external imposition of "do not do it, it is risky!"; instead, it is the experience of "awe" of the beautiful capabilities of the brain. Teachers are also a strength to the students; they hold the community goal of a healthy vision for adolescents and onwards for children. Building community connection, belonging,

and social engagement through mutual goals gives a sense of universality, "all-in-the-same-boat" phenomenon (Giacomucci, 2021).

Family is also a source of strength. It has been mentioned before that successful curriculum prevention includes parents' participation in the program. Parents can also learn the curriculum and apply it to their personal lives. Parents accompany children in reaching healthy goals that impact their academics and family relationships. When parents and children do activities in a positive environment, their interaction invigorates. Lastly, technology is an asset that can be used to foster the knowledge of neuroscience. The curriculum gives additional videos and free materials that can be accessed anytime from a computer or any other internet device. The Multi-Tier System of Support (MTSS) is an enormous source of support for the curriculum through the many other mental health activities and programs that interconnect with its goals.

b. Mindfulness: A key tool for a healthy brain

Mindfulness is the practice of being in the present moment without judging thoughts and sensations that come to the mind. Mindfulness brings the person to awareness or a conscious state of the moment-to-moment experience (Beauchemin, 2016). The main components of mindfulness are intention, awareness, attention, and non-judgmental attitude (Beauchemin, 2016). Intention has to do with putting the effort of focusing on something with determination; awareness is the level of consciousness at which the person relates to internal and external experiences, attention is choosing one main object or sensation as the main focus of the experience, and non-judgment attitude can be thought as not putting labels to the experience (Beauchemin, 2016). Daniel Siegel, an expert on the study on the neuroscience of mindfulness and founder of the Mindsight Institute, in his Comprehensive Interpersonal Neurobiology course (IPNB) (Siegel, 2020), compares mindfulness practice with a camera on a tripod -The Three Pilar Practice of Mindsight- the lens is the "ability to perceive the mind",

the three legs are, observation, objectivity, and openness. Observation is the metacognition of being an observer of the experience. Objectivity is the "quality of awareness from the object of attention," this is what comes to the mind are just thoughts or feelings; they might not be absolutely objective and do not define the person; openness means to be open to what it is happening as the way it is happening, and not being swept by "shoulds of expectations" (Siegel, 2020). According to Siegel, having observation, objectivity, and openness are the basis of awareness or consciousness, which is necessary to make changes within the brain and the other parts of the body and will result in different behaviors and better relationships with the rest of the world (Siegel, 2020). Brain changes through mindfulness practices include the growth of the corpus callosum, the hippocampus, the prefrontal cortex, and the interconnectum (Siegel, 2020). The growth of these parts of the brain integrates brain functions and makes a healthier brain (Siegel, 2020).

Growing research shows that mindfulness practices help "modulate cognitive, affective, and psychophysiological processes integral to self-regulation and reward processing" (Garland & Howard, 2018, p.1). When a person puts their intention into something, like the breath or an external object, they disengage from the noise of their thoughts and emotions. Still, the awareness of this state allows the person to experience how sensations and thoughts try to interrupt the focusing experience (meta-awareness). The attention brings the person back to the purpose of the mindful activity, which is called "attentional re-orienting" (Garland & Howard, 2018, p. 2); usually, it is to come back to the main focus (i.e., the breath, a body part or a natural scene). Because there is no judgment on thoughts and sensations, they just come and go. The former allows the person to detach from feelings and disconnect from the automatic response that one could have without being aware of the state of the mind (Siegel, 2020).

On the other hand, mindfulness practices help to reduce stress by disconnecting the autopilot response (Priddy et al., 2018). The state of awareness that mindfulness practices help to attain provides a strategy to realize when there are triggers to stress and negative affect (Garland & Howard, 2018). The person can develop insight into what is truly going on with their feelings, thoughts, and emotions. In this way, the person can reduce the stress response on time before it takes over; it is a way to do cognitive restructuring (Priddy et al., 2018). The person practicing mindfulness can observe distressing thoughts as a spectator and accept feelings and thoughts like a "parade" passing by (Beauchemin, 2016). Mental clarity will allow one to solve the issue and see possible positive and negative consequences for different paths of action, as well as give more freedom to make better choices and avoid risky situations (Priddy et al., 2018). Due to this mental exercise, executive control function is heightened, and stress reactivity decreases (Priddy et al., 2018). There is enough research that shows the connection between stress and substance use (Priddy et al., 2018); therefore, finding mechanisms that deescalate stress is an essential preventive strategy.

The first thing a person needs to learn when practicing mindfulness is to pay attention to the breath. The pattern of the breath will influence the brain; it will affect the areas that deal with emotion, learning, and cognition, such as the amygdala, the hippocampus, and the prefrontal cortex (Miller, 2023), which are part of the reward system that is primarily involved in addictive processes. As an example, in a randomized controlled trial that examined how mindfulness practices affected neural mechanisms connected to stress, the participants (nicotine-dependent smokers) had much less activation of the amygdala and insula when exposed to a stress trial than the control group who did not participate in a mindfulness training (Priddy et al., 2018). Thence, the relation between the breath and the brain will affect how a person performs emotionally, uses memory, and executes the connectivity between brain areas (Miller, 2023). As Dan Siegel teaches in the IPNB course,

"awareness of the sensation of the breath strengthens the capacity to focus attention… focusing on the breath is a very important way of creating a stronger mind…the focus on the breath seems to strengthen your capacity to stabilize attention" (Siegel 2020). In other words, focusing on the breath helps to self-regulate because one can monitor sensations with a more stable state of mind. In the book The Healing Power of the Breath, the authors explain how heart rate variability (HRV) changes by how breathing is done, and these shifts are reflected in the nervous system activity as well (Brown & Gerbarg, 2012). HRV is calculated by the number of breaths a person makes in a minute; there are diverse ways to do breath practice: "Coherent Breathing, Resistance Breathing, Breath Moving, Total Breath, and Body Scan" (Brown & Gerbarg, 2012. P. 3). According to Brown and Gerbarg (2012), learning breathing techniques helps to have a higher HRV, which means having "a healthier, more flexible cardiovascular system, a more balanced and resilient stress-response system, and overall greater health and longevity" (Brown & Gerbarg, 2012, p.11). The sympathetic or alert system and the parasympathetic system or the relaxed system work together while inhaling (sympathetic) and exhaling (parasympathetic) during breath work, balancing both and integrating the autonomic system (Siegel, 2020).

Mindfulness is an effective preventive strategy against addiction, not only because it helps to be aware of the relation between the breath, the brain, and the mind, but also because it is a buffer against automaticity, compulsivity, and cravings which are the impulses underneath addiction (Garland & Howard, 2018, p. 4). This happens because mindfulness strengthens the prefrontal cortex, essential in cognitive control and decision-making (Garland & Howard, 2018, p. 4). Mindfulness practices grow GABA (Gamma-Aminobutyric Acid) inhibitory fibers from the regulatory prefrontal cortex to the emotionally based hippocampus, linking these two areas (Siegel, 2020). It boosts self-regulatory executive function over the limbic system, calming the amygdala, leading to healthier and wiser decisions (Garland &

Howard, 2018). At the same time, mindfulness helps the reward system focus on natural pleasures (savoring). It expands the number of activities that can be meaningful and rewarding during a regular day (Garland & Howard, 2018). For example, mindful eating and mindful walking, which also promote positive affect and emotion regulation. Garland has named this the "restructuring reward hypothesis" (Garland & Howard, 2018, p. 14). For all the former reasons, mindfulness interventions have been used in addiction treatment and relapse prevention with positive results, e.g., Mindfulness-Based Relapse Prevention (MBRP) and Mindfulness-Oriented Recovery Enhancement (MORE) (Garland & Howard, 2018; Priddy et al., 2018).

Teaching children about mindfulness early on will encourage them to adopt mindfulness into their lifestyle. The importance of creating a regular routine is optimal in the acquisition of making a habit of having a daily session of mindfulness. Also, it trains the brain through the activation of neuroplasticity on how to respond better to any given situation during the rest of the day; this is called the acquisition of a mindful trait (Garland & Howard, 2018; Siegel, 2020). This happens because every time a person repeats an activity, in this case, the focus of attention, there are neuro-firing patterns; neurons connect repeatedly, strengthening the synaptic connections between them and creating action potentials that generate long-lasting pathways in the brain, which are new learnings (Siegel 2020). These new learnings in practical language for children are peaceful solutions to conflict, more empathy and kindness with themselves and others, a higher focus on academics, and strengthening resilience, among other examples.

The mindful disposition that mindfulness practice brings builds "the capacity to remain nonreactive to and accepting of distressing thought and emotions; observe interoceptive and exteroceptive experience; discriminate emotional states; and be aware of automaticity" (Garland & Howard, 2018, p.2). In this way, as children grow, they can help themselves to

calm down, self-regulate, and focus on what is truly meaningful to them, taking care of themselves and their relationships with their peers and families.

The growing evidence that mindfulness helps with self-regulation has led some schools to incorporate mindfulness practice into the socio-emotional learning skills taught at schools (Lee, 2022). By practicing mindfulness, students will behave well, regulate their emotions, solve conflicts better, become resilient, and enhance academic performance (Garey, 20224). There are some curriculums that promote mindfulness practices in elementary schools, such as MindUp by Scholastics and Mind Schools. However, the connection of mindfulness practice with a neuroscience-based curriculum for addiction prevention in elementary schools should be visible. Mindfulness practices such as deep breathing, guided imagery, kindness mindfulness, progressive muscle relaxation, mindful eating, and the Wheel of Awareness (Siegel, 2011) within the proposed neuroscience-based curriculum model for addiction prevention can help close this gap.

Note: The following section begins with an example of the curriculum for elementary schools. It was developed for fourth-grade students. The methodology will be a two-hour session with a break in between. There will be an activity to do at home with the parents. If the school has a middle school and high school, it is recommended that middle or high school students participate in helping the teacher with the activities. The curriculum gives an example of how to integrate older students in the exercise of *The Wheel of Awareness* from Dr. Dan Siegel.

Proposed Neuroscience-Based Curriculum Model for Addiction Prevention For Fourth-Grade*

Overview

In this lesson, students will learn about the importance of the brain and how it is the most powerful part of the body. The focus will be the study of how the reward system works and how drugs and alcohol affect the brain. Also, they will learn how mindfulness practice helps them take care of their brains, self-regulate, and have better relationships with friends and family.

Learning Outcomes

• Students will demonstrate that the brain is a powerful strength that is there to be used and shaped.

• Students will explain the importance of the brain for the body's normal functioning.

• Students will illustrate the main parts of the brain.

• Students will demonstrate an understanding of the reward system.

• Student will appraise the negative consequences of drugs and alcohol in the reward system.

• Students will develop a love for their brain.

• Students will improve self-care and apply mindfulness practices to handle negative emotions.

* This curriculum is based on the content of *The Brain: Understanding Neurobiology Through the Study of Addiction.* U.S. Department of Health and Human Services, National Institutes of Health, and National Institute on Drugs Abuse. (2010). It also contains educational videos and interactive activities.

Neuroscience of Addiction for Four-Grade Students

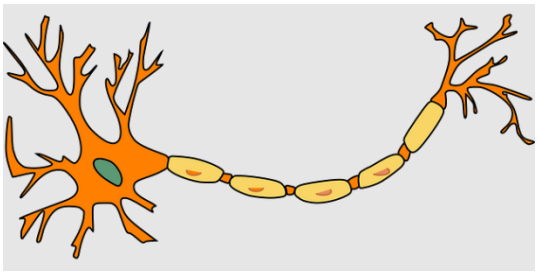
a. The awareness of my brain: My brain, my strength

You have a brain! Do you know what the brain does? The brain controls every activity we do, feel, and process in our minds. Think about how flowers smell… Imagine when you are about to shoot the ball and are trying to get it into the basket, or when you are angry because a friend took your cereal bar without permission, or you are sleepy and want to go to bed. All these activities are controlled by your brain.

Optional Fun Activity: Play Simon Says for two minutes as an analogy of the commanding function of the brain.

Watch the video (6.56 min): The Brain for Kids- How Does the Brain Work? (Learning Videos for Kids) https://www.youtube.com/watch?v=FmeRbK5zhOs

A person's brain needs around 24 years to develop, so we must take care of it and not interrupt its natural development process. Our bodies have trillions of cells. A cell is the smallest unit of a living thing. The cells of the brain are called **neurons**. Neurons communicate with each other and pass information by delivering different chemicals called **neurotransmitters**. Through the communication of neurons, you are learning about the brain now! Neurons are like branches of a tree; every time you learn new things, a new branch grows, and more connections are made between them.



A neuron. Source: Pixabay

If you want to know more about neurons watch this fun video by BrainFacts.org (3:13 min). How neurons work https://www.youtube.com/watch?v=EyUTGC1bm8Y&t=19

Various parts of the brain carry out specific functions through neurons. If a part of the brain is damaged, it cannot function well, just like any other part of our body that has been harmed. Think about when someone must wear an orthopedic boot because they twisted an ankle while playing sports. The foot cannot function well and needs to be healed before it can kick again. The same happens with the brain, it will not work properly if there is a major accident that involves the head or if we consume unhealthy substances.

Watch the video (3.25 min.): A tour of the Brain - Self-Regulation 1 by Mineola Grows! https://www.youtube.com/watch?v=Q6vqSehMYQQ

When different brain parts work together, they are part of a system. One of these systems is the limbic system, which is responsible for motivation, emotion, learning, and memory. Within the limbic system, there is another system called the reward system. One of the main parts of these two systems is the **amygdala**, which is affected by stressful situations. The amygdala responds to stress like an emergency siren and prepares the body to fight or flight. Over time, stress weakens the defense system and alters the natural balance within the body, and we can quickly get sick. Stress also prevents people from concentrating and doing well in school. For these reasons, it is essential to learn techniques to reduce stress.

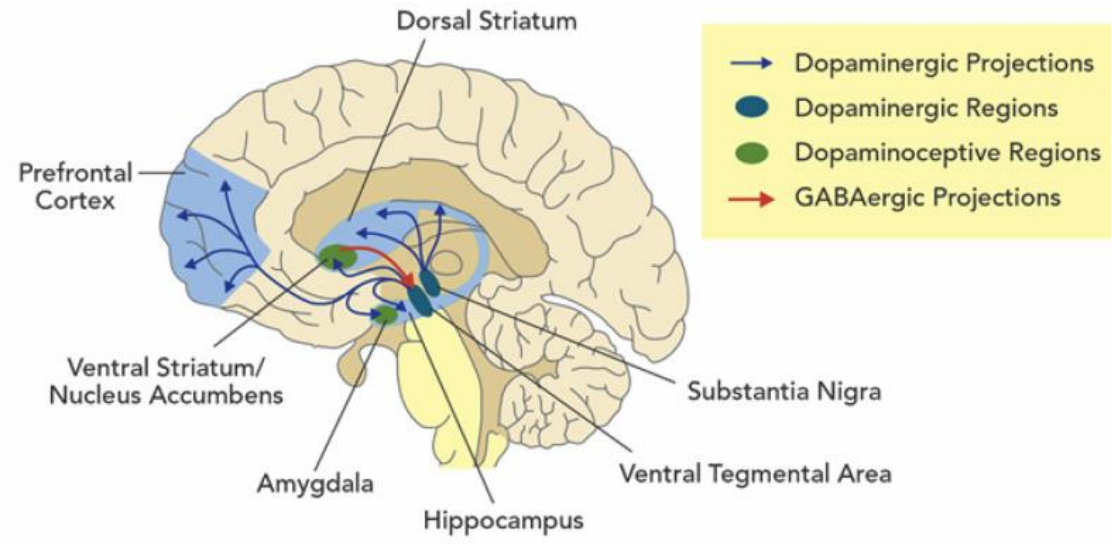
Watch the video to know more about the amygdala and the stress response: Fight Flight for Kids by Curious Kids Psychology (4.01 min). https://www.youtube.com/watch?v=1VQUOr-R3eA

b. The reward system

The main parts of the reward system are:

- The ventral tegmental area (VTA) (Monitors dopamine production).
- The nucleus accumbens (the brain's pleasure center, dopamine is released here). There is one nucleus accumbens in each cerebral hemisphere, left and right.
- The prefrontal cortex (helps make decisions, plan, and control impulses).
- The amygdala (emotions, including stress). There is one amygdala in each cerebral hemisphere, left and right.
- The hippocampus (memory). There is one hippocampus in each cerebral hemisphere, left and right.

In this picture, you can see all the parts of the reward system. The brain is cut in half. It has other parts of the reward system, but we will only focus on the ones listed before.



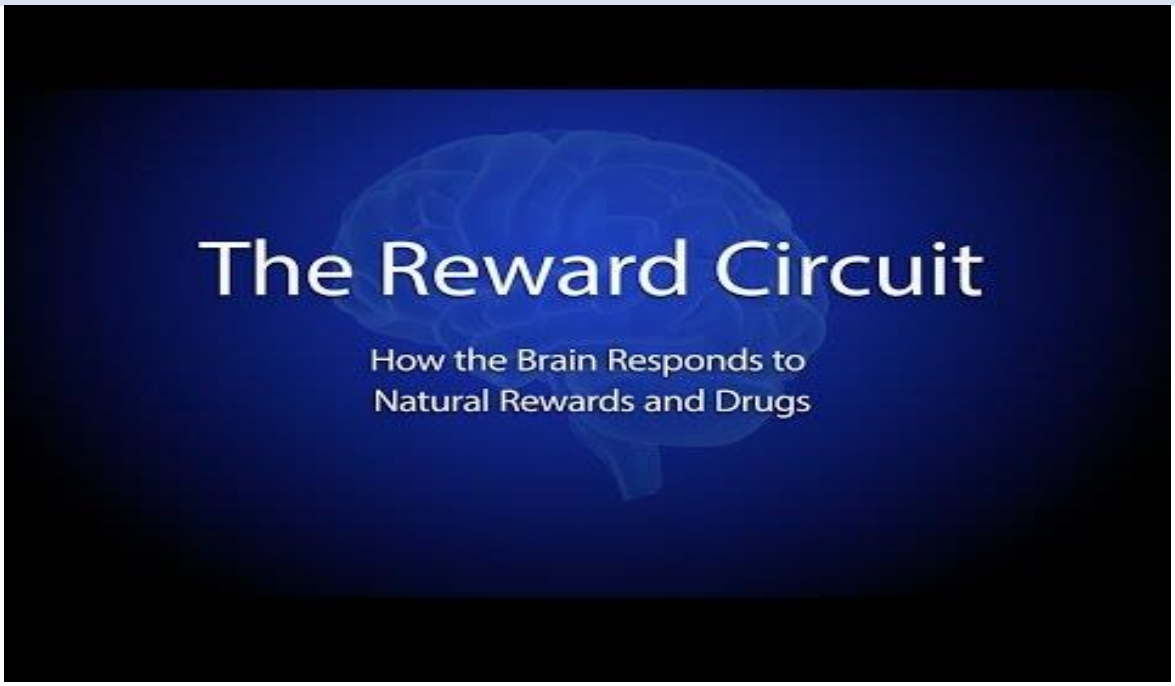
Source: From Telzer (2016). Adapted with permission from Elsevier. In Treatment for Stimulant Use Disorder. SAMHSA (2021).

What is a reward?

A reward encourages us to do or avoid something. Reward is when you receive a gift or an award for something you have done well. For example, you get rewarded when your teacher gives you a token because you did a wonderful job in class. When we receive a reward, we want to repeat what we have done to get the pleasure that the reward produces again. We experience pleasure because neurons in the VTA area release the neurotransmitter **dopamine** in the reward system, specifically in the **nucleus accumbens**.

Our brain's reward system helps us survive by telling us to eat, drink, and have fun. Because the reward system stores the good and the bad memories through the amygdala and the hippocampus, it helps us create habits. Habits can be good habits but also unhealthy habits. Let us say you go to a friend's birthday party, and you eat delicious cupcakes; your **amygdala** and the **hippocampus** store that information so that the next time you go to another party, you will remember the color, flavor, smell, and taste of the cupcakes from the first party. You would want to eat them again to feel the pleasure you experienced while eating them.

Watch the Video: The Reward Circuit. How the Brain Responds to natural Rewards and Drugs. NIDA. https://www.youtube.com/watch?v=DMcmrP-BWGk



Unfortunately, other things can make us experience pleasure and feelings of happiness. Still, they are not healthy and are very harmful, like alcohol and drugs. When people consume these substances, the amygdala and hippocampus again store the feelings and memories of pleasure associated with the substance, and the person will want to have those sensations again. With alcohol and drugs, the reward system gets more activated than usual because more dopamine at a faster speed is released than when eating food and less **serotonin** is released. Serotonin is another neurotransmitter that helps us to feel satisfied. Drugs and alcohol change the way neurons communicate. It makes them communicate faster or slower. These substances also block the neurotransmitters from getting removed from the nucleus accumbens as they should be in regular dopamine release. Excess dopamine stays in the nucleus accumbens, and the brain cannot function well. Remember that the brain is the

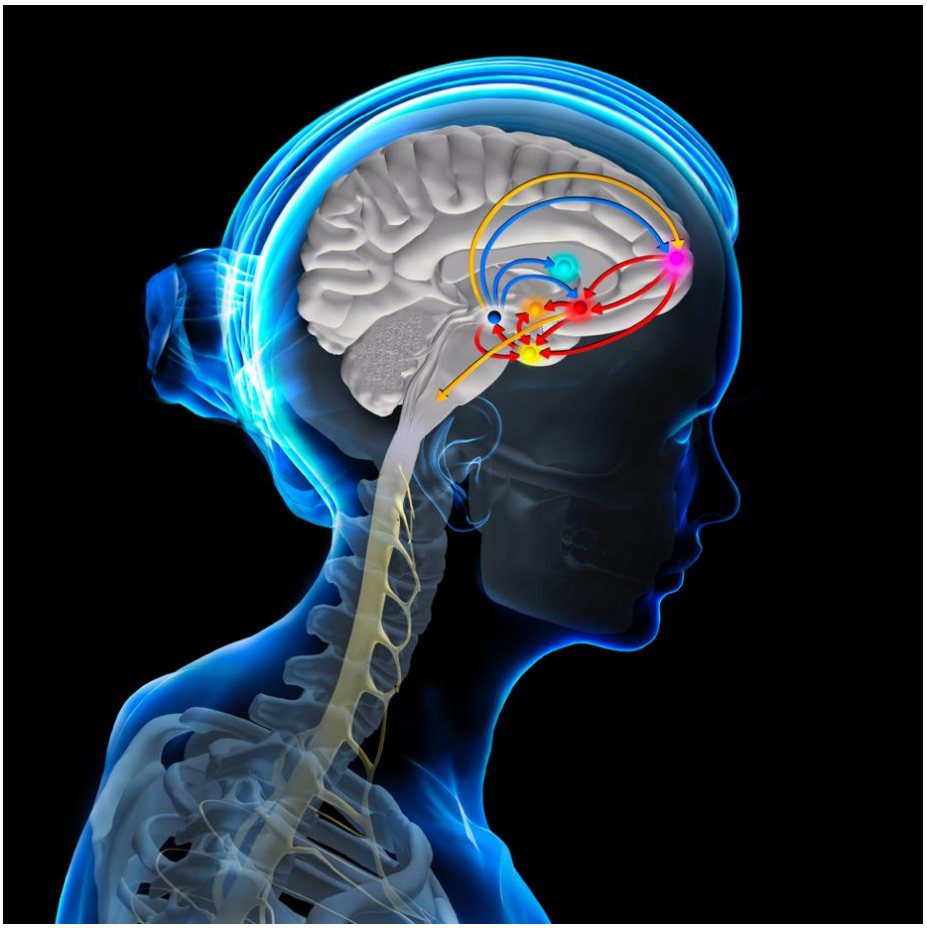
one that manages all activities, so if the brain is not working well, we cannot think clearly, behave well, eat well, etc.

Drugs and alcohol are substances that are external to our bodies, and our bodies do not need them; they mess up the natural processes of the brain. They reduce chemicals that are necessary and can even kill neurons. They also alter our mood, sleep, motivation, concentration, memory, and decision-making power.

The pleasure experienced with drugs and alcohol makes people want to repeat it, damaging the reward system and losing the power of self-control. The brain gets used to these enormous quantities of dopamine, and even alcohol and drugs lose the ability to satisfy the damaged brain demands. When the brain reaches this point, we call it **tolerance** because the person can tolerate a large amount of dopamine. Therefore, alcohol and drugs hijack the brain, and this is called **addiction**. Suppose the person stops using drugs and alcohol. In that case, they will experience something called **withdrawal** symptoms for a certain amount of time: feeling sick, unable to sleep well, anxiety, depression, memory loss, and many other more uncomfortable symptoms that would trigger the person to want the drug again to feel "happy." The **cravings** for the drug or alcohol can lead to a cycle of addiction, where even though the person wants to quit consuming these substances, the person gets stuck in the wanting-withdrawal-craving-wanting cycle. If the person can wait and does not consume drugs or alcohol, the brain will start to heal, but it will take a lot of effort and help. Sometimes, part of the damage is irreparable.

Watch the video (2:54 min) The Science of Joy: Exploring Dopamine and Natural Highs by Natural High. https://www.youtube.com/watch?v=3MeMCoFPSpM&t=2s

Looking at this picture, can you imagine the reward system in your brain?



Source: Fernando DA Cunha/Science Photo Library

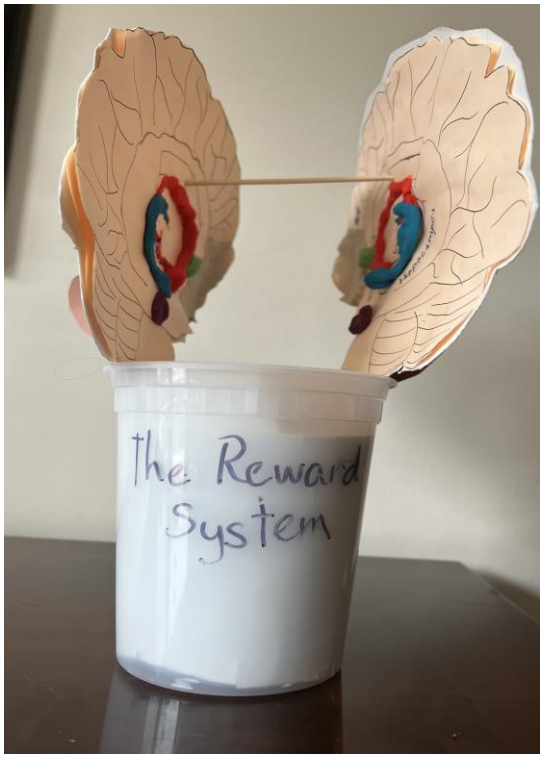
c. **Home connection:** In this section you will find interactive activities to reinforce the concepts you have learned. Watch the video (6.33 min) with your parents and create a reward system with playdough.

https://youtu.be/w_OeSmEJQCc?si=np15pRI_vWVmnGyw

- Print the two hemispheres of the brain in the following links and cut the patterns.

https://drive.google.com/file/d/1XG1b9LT1ANjPPV1n_lai1u0R6uUVOzWd/view?usp=sharing

https://drive.google.com/file/d/1S859cQq0-atgD1W9KfHOrXx_el5xsPlI/view?usp=sharing

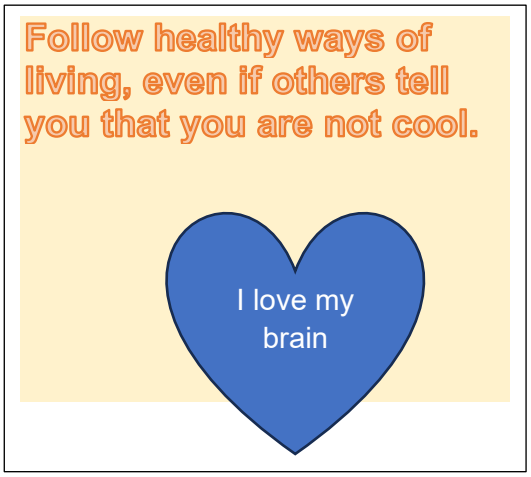


Materials:

- Playdough of five assorted colors,
- hard paper
- a stick,
- a jar, or a bucket that can hold the two hemispheres,
- hot glue to hold the two hemispheres together and paste them to the jar.

- Did you know that there is a webpage where you can open the brain and look at all its parts and move them around? This amazing webpage is: https://www.brainfacts.org/3d-brain#intro=false&focus=Brain-limbic_system-amygdala

  Find the five main parts of the reward system: the ventral tegmental area, the nucleus accumbens, the amygdala, the hippocampus, and the prefrontal cortex. Enjoy the experience!



Cartoon from Emily Hacker (April 2, 2019). Taken from: https://pldlamplighter.org/features/2019/04/02/peer-pressure-in-teenagers/

The most common substances young people can get addicted to are cannabis, commonly called marijuana (THC), and alcohol.

Watch the interactive activities to learn how these two substances affect the brain.

Cannabis and the Brain. NIDA.

https://nida.nih.gov/themes/custom/solstice/interactive/cannabis/

Alcohol and Your Brain: A Virtual Reality Experience. NIDA

https://www.youtube.com/watch?v=wHmf-uxOcLc

d. The self-care of my brain: Mindfulness, a key tool for a healthy brain

We have said before that the brain needs 24 years to fully develop; the last part that develops is the prefrontal cortex, which is the one that makes decisions, plans, solves problems and controls impulses. When we are young, our reward system is more robust than the prefrontal cortex, and sometimes, it is difficult to follow orders. For example, when we are little, we sometimes have difficulty understanding the reasons that our parents give us, and we beg to get what we want. We can help our brain grow healthier by fortifying the

prefrontal cortex through something called **mindfulness**. In this way, we can control our impulses. Even though the brain develops until the mid-20s, that does not mean that the brain cannot change anymore. The brain can change; this capacity is called neuroplasticity; the brain is plastic, like a rubber band that can be stretched or shrunk. Practicing mindfulness activates neuroplasticity, and neurons in the prefrontal cortex can grow and link between them to control the limbic and reward systems. In this way, we strengthen our capacity to make better decisions and regulate our emotions. Three ways of practicing mindfulness are deep breathing, mindful eating, and the wheel of awareness.

Exercise 1- Deep breathing

In a comfortable position, with legs uncrossed and closed eyes, if that feels okay, take a deep breath, focus your attention on how your breath enters your nose, goes through the chest, and fills your stomach. You can place your hands in your stomach to feel how the air fills it and then slowly release the air.

Continue feeling your breath entering through the nose and feel the awareness of the wave your breath makes. If a thought comes to your mind, just think they are clouds passing by and gently come back to your breath.

Distractions are just thoughts visiting for a while, and with kindness, you let them go and return to focus on your breath. As you follow your breath, imagine you are sitting on the beach, and waves are coming and going. There are small waves and more giant waves. Sometimes, the waves get huge and seem they are going to reach you, but they fade away. These waves represent your thoughts, sensations, worries, and feelings. Observe how they rise and fall without harming you. They are part of your mind, but they are not you; there is a space between the waves and you; you are an observer sitting on the beach, just enjoying the scene as if watching a movie. Now, return to the sensation of the breath five more times and slowly open your eyes.

How was that experience for you?

Now you know you have a tool to calm down; the amazing thing is that breathing is always with you!

Affirmations:

• I want to stay healthy.

• My brain is an incredible part of my body.

• My brain helps me to reach my goals.

• I love my brain, and I take care of it.

• My brain is one of my powerful strengths.

I respect my brain, and I promise to never harm it.

• When I feel upset, angry, stressed, or annoyed, I take deep breaths and bring to my mind my happy place.

• Doing mindfulness exercises makes my brain stronger.

• I honor myself when I do acts of kindness to my brain and others.

Exercise 2- Mindful eating: The chocolate exercise (Children are given a small chocolate bar)

Look at the wrapping of the chocolate bar; what thoughts come to your mind? Maybe you have eaten this brand before and are curious about the new taste. Perhaps you remember the taste and already have saliva in your mouth. What color is the wrapping?

Remove the wrapping slowly… do you feel the need to eat it right away? Sense your breathing; are you breathing faster?

What physical reactions are you experiencing?

What thoughts come to your mind?

Take deep breaths.

Imagine the people who harvest the cocoa beans, the factory workers who shape it. Thank them for their work.

Cut the chocolate in half and feel the texture. Take it closer to your nose and smell it. What makes you think its aroma is?

Closing your eyes, take a deep breath.

Put the chocolate in your mouth and let it stand there for five seconds.

What do you feel as it melts?

Start chewing it slowly. How is the taste?

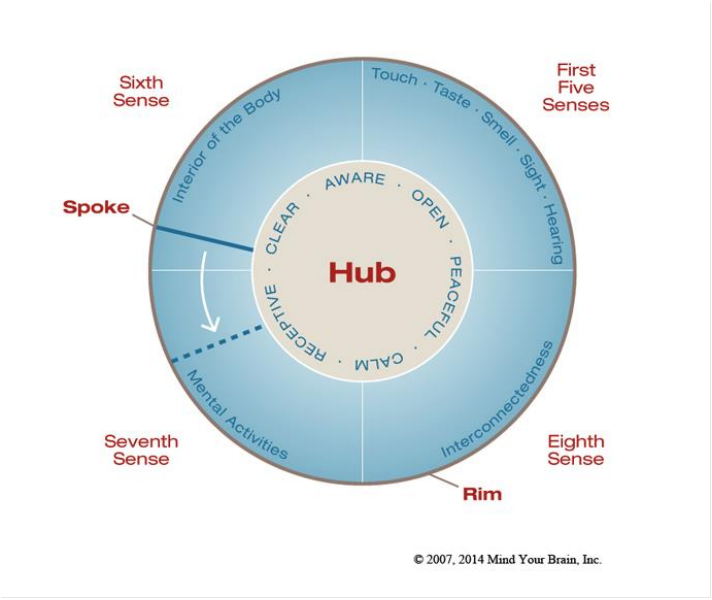
In which part of the mouth is it now?

Swallow the chocolate and take two deep breaths.

Take the second part of your chocolate and move your tongue around your mouth. Has the experience changed from the first piece of chocolate?

Enjoy savoring this piece of chocolate with gratitude and feel how it moves to your stomach to give you energy.

Exercise 3- The Wheel of Awareness with Older Peers: A mindfulness practice by Dr. Dan Siegel (https://drdansiegel.com/wheel-of-awareness/)



This exercise can be done in the classrooms with the teacher having the image of the wheel of awareness on the board, or if it is possible, students from high school or middle school can participate by drawing with chalk on the floor in a larger area (cafeteria, basketball court) as many wheels of awareness as students in the fourth-grade class. If the second option is available, high schoolers and middle schoolers will need previous knowledge of the content of this curriculum and the exercise. In this way, they can support the teacher in explaining what the wheel of awareness means to each student.

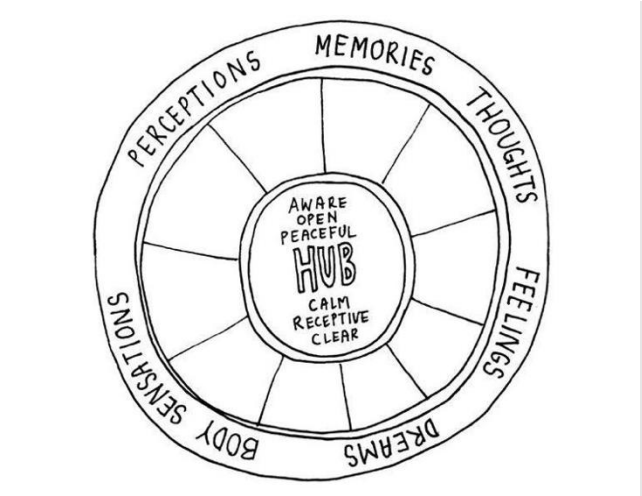


Image taken from the Book *The Whole-Brain Child.* Dan Siegel and Tina Payne Bryson (2012). Bantam

Start the exercise explaining the meaning of awareness. Awareness means that we realize what is happening inside or around us. We notice what we are paying attention to. Imagine your mind like a bicycle wheel. The wheel has a hub, representing the center of your mind, where you can direct your attention to the distinct parts of the rim. In the hub, the mind is clear and aware of what is happening; it is a peaceful and receptive place representing the prefrontal cortex. It does not criticize thoughts and sensations. The rim of the wheel represents where we are focusing our attention. The rim has a section for our senses: touch, smell, sight, taste, and hearing. Another part of the rim takes us to the sensations of our body: face, lungs, heart, intestines, and limbs. Another point of the rim is our perceptions,

memories, thoughts, feelings, and dreams. The last section of the rim is relationships: family, friends, teachers, people in your neighborhood, city, other countries, and the whole world.

Let us begin: Imagine that this wheel is your mind (your thinking), and you are going to be at the hub (Children stand or think they are at the hub of the wheel). This is your happy, peaceful place. Let's start by taking deep breaths... Now, you are going to focus on looking at the part of the rim that has your sensations:

What do you see?

What do you hear?

What do you smell?

What are you tasting?

What are you touching?

Now, come back to the hub and take some deep breaths again.

You are going to the rim again, this time focusing on the part of the rim where the inner sensations of the body are located. How is your body feeling right now? Is it cold, hot, sweaty, or tired?

Hear your heart…

your stomach…

Feel the air coming through your lungs and going out.

Are your legs heavy or light?

Return to the hub again and focus on the breath for some moment.

Now, you go back to see the rim but focus on the memories, perceptions, thoughts, feelings, and dreams. What are you thinking right now?

Are you worried or at peace?

How can you describe your emotional state (frustrated, happy, angry, disappointed, excited, afraid)?

Does any memory come to mind? You can choose to stay longer in the thought that comforted you the most, the one that makes you happier.

Come back to the hub and breathe again slowly.

You are now going to the last part of the rim, where relationships with other people are located.

Think about your family… send hugs and love.

Think about your friends…send appreciation for their talents and company.

Think about your school…

Think about your neighborhood…city…country… and the whole world.

Send wishes of peace and connection to all of them.

Come back to the hub and breathe deeply again. Think about what you just did looking around the wheel.

As we finish, realize that you can imagine being on the hub and possibly focusing on any part of the rim at any moment in your day. Focusing your attention while taking deep breaths can help you calm down and see things more clearly; you can always choose where you focus your attention. It is better to focus on things that bring you joy and peace than thoughts that worry you. But if these worries come, see them as simple thoughts from the hub. Remember, you are not only one part of the rim. The rim has many components; you can choose where to focus your attention.

Watch other kids talking about mindfulness (3.41min.) "Just Breathe" by Julie Bayer Salzman & Josh Salzman. Wavecrest Films.

https://www.youtube.com/watch?v=RVA2N6tX2cg&t=4s

e. More Resources

- The Human Brain: Major Structures and Functions. NIDA https://www.youtube.com/watch?v=0-8PvNOdByc&t=133s
- Get Excited About the Brain: A coloring & activity book for kids aged 8-12

https://www.nimh.nih.gov/sites/default/files/health/publications/get-excited-about-the-brain/get-excited-about-brain-activity-book-508.pdf

- Spanish version: https://www.nimh.nih.gov/health/publications/espanol/el-emocionante-mundo-del-cerebro
- Stand Up to Stress: A coloring & activity book for kids ages 8-12 https://www.nimh.nih.gov/sites/default/files/documents/health/publications/stand-up-to-stress/stand-up-to-stress.pdf

  Spanish version: https://www.nimh.nih.gov/health/publications/espanol/hazle-frente-al-estres
- NIDA (2021). Nurturing my mental & emotional health. https://nida.nih.gov/research-topics/parents-educators/lesson-plans/nurturing-my-mental-emotional-health

Recommended books:

- No Snow Day For the Brain. Rebecca Hammond, Kate Brown, Rebecca Hammond, Alex Nisbet. (2022). Nancy Michael (editor). Illustrations by Olivia Schenck.

https://www.lulu.com/shop/alex-nisbet-and-rebecca-hammond-and-kate-brown-and-olivia-schenck/no-snow-day-for-the-brain/paperback/product-2y56e2.html?page=1&pageSize=4

- Now Maps: A Tween's Guide to Learning About Your Thoughts, Navigating Big Emotions, and Being a Confident Kid (2022). Daniel J. Siegel & Deena Margolin

Note: End of the curriculum model section.

VII. Implications for Schools, Public Policy, and the Social Work Profession

Addiction prevention strategies should touch all levels of the person because addiction is a multifactorial brain disorder. Schools should incorporate preventive science education from kindergarten through college education. Bosworth & Sloboda (2015) stress the urgency for the provision of prevention specialists "in both intervention and research" to link the different sectors within the system and promote cooperation among them (Bosworth & Sloboda, 2015. P. 414). The MTSS has helped to make advances in prevention with the different tiers of support for students and the provision of internal and external resources for schools, especially by giving emphasis on the socio-emotional learning skills (SEL) and trauma-informed framework. However, there is a need for more prevention specialists, especially educators, to receive training in fundamental neuroscience to help children understand the connection between the neurophysiological, emotional, and social components that are translated into their behaviors. Schools must include families as much as possible in these new learnings as the home environment is also part of the problem and the solution.

Substance use addiction statistics are a concern for society since it affects the general well-being of the person and may increase the heritability of addiction to the subsequent generation through the changes that substance use makes in the epigenetics (gene expression) of the person that consumes the substance and the offspring (Vassoler & Sadri-Vakili, 2014). Addiction damages relationships in the family and has public costs in the mental/physical health and justice systems. NIDA shows that "almost 44 percent of drivers in fatal car crashes tested positive for drugs" (National Institute of Drug Abuse, 2019. p.1). “Columbia University’s National Center on Addiction and Substance Abuse reports over 75% of state penitentiary inmates require drug abuse treatment” (Saah, 2005. p.10). This same center stated in the report of the year 2011 that: “Adolescent substance use is America’s #1 Public health problem” (Columbia University’s National Center on Addiction and Substance Abuse,

2011). Substance use disorder is one of the main causes of homelessness (National Coalition for the Homeless, 2017).

Public policy efforts and school disciplinary actions should focus more on prevention and treatment than punishments. In longitudinal research, Prins et al. (2023) found that there is a connection between exclusionary discipline and the increase in substance use, and subsequently, those who were exposed to exclusionary discipline and substance use were at high risk of getting into the criminal justice system as adults (Prins et al., 2023). Exclusion and rejection are only going to augment the problem for the individual and society in general, not to mention that minorities and the black population will be at a higher risk of being a target of exclusionary policies due to discrimination (Prins et al., 2023). At the individual level, it affects self-esteem significantly, may lead to social isolation, and increases the risk of suicidality. Societally, exclusionary discipline supports the school-to-prison pipeline outcomes (Prins et al., 2023). The way a problem is approached makes a whole difference. The words society uses, the tools implemented, and how the goal is set will affect the results. Even though restorative discipline in Texas was implemented in 2015 to overcome schools' mismanagement of disciplinary actions (TEA, 2024), substance use stigma is far from ending. It seems society is reluctant to embrace a positive framework.

The lack of approaching socio-economic and developmental causes of misbehavior has resulted in mass incarceration and mass criminalization that have augmented the public health crisis (Prins et al., 2023). Research has helped to dismantle the false idea that punishment in children and adolescents conduces to better behavior; on the contrary, it creates resentment and goes to the detriment of educational outcomes, disconnection to the social support of the school, and negative school climate (Prins et al., 2023). As Dr. Ross Greene has said through his Collaborative & Proactive Solutions (CPS) model, every child wants to do good; if they

do not behave well, it is because they are lagging specific knowledge or skills that are preventing them from reaching high expectations that do not consider their needs (Greene, 2024). Children are more vulnerable to mistreatment, misdiagnosis, and injustice from the social system because they are not able to defend themselves, and they may come from dysfunctional environments. Children spend most of their day at school; schools influence their well-being through the climate, policies, resources, and classroom management (Prins et al., 2023). Therefore, implementing evidence-based holistic practices within schools is essential to prevent substance use. For school staff, social workers, and policymakers, protecting children from an early age is paramount because behavioral problems such as substance use might have grave negative repercussions in adulthood. According to a follow-up of a 40-year-long study in the United Kingdom, behavioral problems during the school years were the highest risk factor that determined the most negative outcome later in life (Mechanic et al., 2014). As Mechanic et al. (2014) stated:

> Having a severe, or even mild, conduct disorder in childhood or adolescence goes along with a range of negative outcomes over time, such as lower educational attainments and earnings, greater risk of teenage parenthood, disengagement from economic activity, and problems with the law"(Mechanic et al., 2014. p.10).

Neuroscience has given much information that the brain is also part to consider in the problematic issue of substance use. Neuroscience has clarified the interaction between the brain, mind, and body. New images like PET scans and fMRI show that structural differences in brain structure affect behavior (Gaskin, 2021). Trauma and chronic stress change the structure of the brain, not only external stress but also internal stress, such as stress that a baby receives in utero from the mother (Yorke & Bergère, 2017). According to Holmes (2019), chronic stress produces changes in the amygdala's size and function, resulting in anxious, depressed, or aggressive children. Holmes concludes that children experiencing

stress will hurt their cognitive function - difficulty learning, storing memory, and concentrating (Holmes, 2019). Under stress, the risk for substance use is high as it is used as a coping mechanism or self-medication for anxiety and depression.

Social workers have a critical role in preventive strategies. Yorke and Bergère (2017) state that social workers should be prepared to work with interdisciplinary teams and need basic knowledge in neuroscience to be more effective in providing an integral biopsychosocial intervention (Yorke & Bergère, 2017). Children's interaction with the environment also involves the interrelation between environment and genes, and environment and physiology. Social workers cannot have a disregard of neuroscience. Social workers working with children should understand the genetics and neurobiology of mental disorders such as substance use to advocate for them. According to Yorke and Bergère (2017), the relation between trauma, stress, epigenetics, substance use, and neuroplasticity is central in social work practice. The authors explain how the environment changes gene expression and how the brain can redirect pathways is an evolving area of study that gives more information to social workers to treat better and help clients change the adverse effects of harmful environments (Yorke & Bergère, 2017). Social workers should have a basic understanding of how mindfulness practices shape the brain. So, clients understand that mindfulness is not just something about using a popular relaxation technique but a practice with scientific research behind it.

Lastly, with the increasing legalization of marijuana in many states, public policy should be careful in how they communicate this new regulation. According to the American College of Pediatricians (2018), teenagers misperceive it thinking that marijuana is a medicine, and if it is legal, it is because it is not harmful (American College of Pediatricians, 2018). Policymakers should send a clear message publicly: Legalization does not mean unharmful or healthy. Public advertisement of this type of content should be visible, and stricter

supervision should be done to the dispensaries as they sell marijuana to teenagers to get profit from a business that might damage their future.

References

Altimus, C. M., Marlin, B. J., Charalambakis, N. E., Colón-Rodriquez, A., Glover, E. J., Izbicki, P., Johnson, A., Lourenco, M. V., Makinson, R. A., McQuail, J., Obeso, I., Padilla-Coreano, N., Wells, M. F., & for Training Advisory Committee (2020). The next 50 years of neuroscience. *The Journal of Neuroscience: The Official Journal of the Society for Neuroscience*, *40*(1), 101–106. https://doi.org/10.1523/JNEUROSCI.0744-19.2019

American College of Pediatricians (2018, April). *Marijuana Use: Detrimental to Youth*. https://acpeds.org/position-statements/marijuana-use-detrimental-to-youth

American Psychiatric Association (2013). *Diagnostic and statistical manual of mental disorders.* (5th ed.) https://doi.org/10.1176/appi.books.9780890425596

Babinski, L., Murray, D., Wilson, W., Kuhn, C., Malone, P. (2018). Impact of a neuroscience-based health education course on high school students' health knowledge, beliefs, and behaviors. *Elsevier. Journal of Adolescent Health*. https://files.eric.ed.gov/fulltext/ED593918.pdf

Belcher, H. & Shinitzky, H. (1998). Substance abuse in children: Prediction, protection, and prevention. *Arch Pediatr Adolesc Med.* 1998;152(10):952–960. https://doi:10.1001/archpedi.152.10.952

Bosworth, K., & Sloboda, Z. (2015). Prevention science 1970-present. In K. Bosworth (Ed.), *Prevention science in school settings: Complex relationships and processes* (pp. 125–149). Springer Science + Business Media. https://doi.org/10.1007/978-1-4939-3155-2_7

Canadian Centre on Substance Abuse (2016). *Neuroscience in youth drug prevention programs.* https://www.ccsa.ca/sites/default/files/2019-04/CCSA-Evaluating-Drug-Prevention-Programs-Neuroscience-Summary-2016-en.pdf

Center for Collegiate Mental Health. (2022, January). 2021 Annual Report. Publication No. STA 22-132. https://ccmh.psu.edu/assets/docs/2021-CCMH-Annual-Report.pdf

Columbia University's National Center on Addiction and Substance Abuse. (2011, June). Adolescent Substance Use: America's #1 Public Health Problem. Retrieved from: Adolescent-substance-use-americas-no-1-public-health-problem.pdf

Debenham, J., Champion, K., Birrell, L., & Newton, N. (2022). Effectiveness of a neuroscience-based, harm reduction program for older adolescents: A cluster randomized controlled trial of *the Illicit Project*. *Preventive Medicine Reports*, *26*, 101706. https://doi.org/10.1016/j.pmedr.2022.101706

DeSilver, D. (2019, February 26). *The concerns and challenges of being a U.S. teen: What the data show*. Pew Research Center. https://www.pewresearch.org/short-reads/2019/02/26/the-concerns-and-challenges-of-being-a-u-s-teen-what-the-data-show/#:~:text=to%20find%20out%3A-

DISA (2024). Marijuana Legality by State. https://disa.com/marijuana-legality-by-state

Drug Abuse Resistance Education (2023). The History of DARE. https://dare.org/history/

Galloway, R., Bronwyn, R., Williamson, J. (2020). Strengths-based teaching and learning approaches for children: Perceptions and practices. *Journal of Pedagogical Research*, *4* (1). https://eric.ed.gov/?id=EJ1265715

Garey, J. (2024). Mindfulness in the classroom. Child Mind Institute. https://childmind.org/article/mindfulness-in-the-classroom/

Garland, E.L., Howard, M.O. Mindfulness-based treatment of addiction: Current state of the field and envisioning the next wave of research. *Addict Sci Clin Pract* 13, 14 (2018). https://doi.org/10.1186/s13722-018-0115-3

Gaskin, S. (2021). *Behavioral Neuroscience: Essentials and Beyond*. Sage. https://edge.sagepub.com/gaskin

Giacomucci, S. (2021). Strengths-Based and Mutual Aid Approaches in Social Work and Psychodrama. In: *Social Work, Sociometry, and Psychodrama. Psychodrama in Counselling, Coaching and Education*, vol 1. Springer. https://doi.org/10.1007/978-981-33-6342-7_9

Goldstein, M. (1990, February). The decade of the brain. *Neurology*. 40 (2) 321; DOI: 10.1212/WNL.40.2.321

Greene, R. (2024). Lives in the Balance. https://livesinthebalance.org

Hall-Long, B. A., & Dishop, M. L. (1999). Never too soon: A pilot first and third grade drug education program. *The Journal of School Nursing: The Official Publication of the National Association of School Nurses*, *15*(3), 34–39.

Harris, S., Doyle, S., Sherritt, L., Van Hook, S., Knight, J. (2013). "This is your brain on drugs": Adolescent substance use prevention through neuroscience education. *Addiction Science & Clinical Practice*. https://ascpjournal.biomedcentral.com/articles/10.1186/1940-0640-8-S1-A32

Hill, K. G., Bailey, J. A., Steeger, C. M., Hawkins, J. D., Catalano, R. F., Kosterman, R., Epstein, M., & Abbott, R. D. (2020). Outcomes of childhood preventive intervention across 2 generations: A nonrandomized controlled trial. *JAMA Pediatrics*, *174*(8), 764–771. https://doi.org/10.1001/jamapediatrics.2020.1310

Holmes, Kimberley (2018, October). Neuroscience, mindfulness and holistic wellness: Reflections on interconnectivity in teaching and learning. Springer. https://doi.org/10.1007/s10780-019-09360-6

Jensen, F. (2015). *The Teenage Brain*. A. Nutt (Ed.). First Ed. EPub Edition. ISBN 978-0-06-206784-5.

Jones, E., Mendel, L. (1999). Assessing the decade of the brain. *Science* 284 739-739(1999). DOI:10.1126/science.284.5415.739

Kamble, S. (2023, January 13). *Mental and Behavioral Health Webinar Series*: Session 1: HHSC's Substance Abuse Prevention Resources. https://www.youtube.com/watch?v=8S6fk05wrn0&t=25s

Kiddo (2020, October 14). Love your brain: empowering kids to understand their emotions. https://kiddomag.com.au/reviews/love-your-brain-empowering-kids-to-understand-their-emotions/

Kumar, R., O'Malley, P. M., Johnston, L. D., & Laetz, V. B. (2013). Alcohol, tobacco, and other drug use prevention programs in U.S. schools: A descriptive summary. *Prevention Science: The Official Journal of the Society for Prevention Research*, *14*(6), 581–592. https://doi.org/10.1007/s11121-012-0340-z

Livingstone, Ch. (2009). The limbic (emotional) system. In Kim Wager & Sue Cox. Chapter 6. Auricular Acupuncture & Addiction. Pages 57-67. *Science Direct.* ISBN 9780443068850. https://doi.org/10.1016/B978-0-443-06885-0.50014-8.

Lee, L. (2022, November 15). Mindfulness in K-12 Schools. *US News*. https://www.usnews.com/education/k12/articles/mindfulness-in-k-12-schools#:~:text=But%20what%20mindfulness%20programming%20looks,parents%20as%20well%20as%20students.

Machado do Vale T., Da Silva Chagas, L., De Souza Pereira, H., Giestal-de-Araujo, E., Arevalo A., Oliveira-Silva Bomfim, P. (2022). Neuroscience outside the box: From the laboratory to discussing drug abuse at schools. *Frontiers in Human Neuroscience*. 16. 10.3389/fnhum.2022.782205. ISSN=1662-5161 https://www.frontiersin.org/articles/10.3389/fnhum.2022.782205

Mechanic, D., Mcalpine, D. Rochefort, D. (2014). *Mental Health and Social Policy: Beyond managed care*. Sixth Edition. Pearson.

Mental Health Policy Institute. (2018, November 1). Mental and behavioral health roadmap and toolkit for schools. https://mmhpi.org/wpcontent/uploads/2019/10/RoadmapAndToolkitForSchools.pdf

Meredith, L. R., Maralit, A. M., Thomas, S. E., Rivers, S. L., Salazar, C. A., Anton, R. F., Tomko, R. L., & Squeglia, L. M. (2021). Piloting of the just say know prevention program: A psychoeducational approach to translating the neuroscience of addiction to youth. *The American Journal of Drug and Alcohol Abuse*, *47*(1), 16–25. https://doi.org/10.1080/00952990.2020.1770777

Mertens, E., Deković, M., Leijten, P., Van Londen, M., & Reitz, E. (2020). Components of School-Based Interventions Stimulating Students' Intrapersonal and Interpersonal Domains: A Meta-analysis. *Clinical child and family psychology review*, *23*(4), 605–631. https://doi.org/10.1007/s10567-020-00328-y

Miech, R. A., Johnston, L. D., Patrick, M.E., O'Malley, P. M., Bachman, J. G., & Schulenberg, J. E., (2023). Monitoring the Future national survey results on drug use, 1975–2022: Secondary school students. Monitoring the Future Monograph Series. Ann Arbor, MI: Institute for Social Research, University of Michigan. Available at https://monitoringthefuture.org/results/publications/ monographs/

Miller, G., (2023, 31 January). *The Vital Crosstalk between breath and brain*. Brainfacts.org https://www.brainfacts.org/brain-anatomy-and-function/anatomy/2023/the-vital-crosstalk-between-breath-and-brain-013123

Napier, C. (2018, September). Integrating addiction into the neuroscience curriculum. *The Journal of Undergraduate Neuroscience Education (JUNE)*. A publication of FUN, Faculty for Undergraduate Neuroscience. *16* (3), E35-E38. https://www.researchgate.net/publication/327916885_Integrating_Addiction_into_the_Neuroscience_Curriculum

National Center for Drug Statistics (2023). Drug Abuse Statistics. National Center for Drug Abuse Statistics. https://drugabusestatistics.org/

National Coalition for the Homeless (2017, June). Substance Abuse and Homelessness. https://nationalhomeless.org/wp-content/uploads/2017/06/Substance-Abuse-and-Homelessness.pdf

National Education Association (2018, March 12). All Hands on Deck: School-Based Programs to Stem Substance Abuse. https://www.nea.org/nea-today/all-news-articles/all-hands-deck-school-based-programs-stem-substance-abuse

National Institute of Health National (2021, September). News in Health. The Power of Peers: Who influences your health? https://newsinhealth.nih.gov/sites/nihNIH/files/2021/September/NIHNiHSep2021.pd

National Institute of Health. (2021, September 8). *Marijuana use at historic high among college-aged adults in 2020*. National Institutes of Health (NIH). https://www.nih.gov/news-events/news-releases/marijuana-use-historic-high-among-college-aged-adults-2020#:~:text=Among%20college%20students%2C%2044%25%20reported,recorded%20in%202018%20and%202019).

National Institute of Drug Abuse (2019, December 3). Drugged Driving Drug Facts. https://nida.nih.gov/publications/drugfacts/drugged-driving

National Institute of Drug Abuse (2021, July 19). *Preventive interventions delivered in childhood may reduce substance use over two generations*. https://archives.nida.nih.gov/news-events/nida-notes/2021/07/preventive-interventions-delivered-in-childhood-may-reduce-substance-use-over-two-generations

National Institute of Drug Abuse (2014). March 31. Prevention. https://nida.nih.gov/research-topics/prevention

Pettigrew, J., Hecht, M. (2015). Developing School-Based Prevention Curricula. In: Bosworth, K. (eds) *Prevention Science in School Settings. Advances in Prevention Science*. Springer. https://doi.org/10.1007/978-1-4939-3155-2_8

Priddy, S. E., Howard, M. O., Hanley, A. W., Riquino, M. R., Friberg-Felsted, K., & Garland, E. L. (2018). Mindfulness meditation in the treatment of substance use disorders and preventing future relapse: Neurocognitive mechanisms and clinical implications. *Substance Abuse and Rehabilitation*, *9*, 103–114. https://doi.org/10.2147/SAR.S145201

Prins, S., Shefner, R., Kajeepeta, S. Levy, N., Esie, P., Mauro, P. (2023). Longitudinal relationships among exclusionary school discipline, adolescent substance use, and adult arrest: Public health implications of the school-to-prison pipeline. Drug and Alcohol Dependence. Volume 251. *Science Direct.* ISSN 0376-8716. https://doi.org/10.1016/j.drugalcdep.2023.110949.

Purdy, N., Morrison, H. (2009, February). Cognitive Neuroscience and Education: Unravelling the confusion. *Oxford Review of Education*, *35*(1), 99-109. Taylor & Francis. https://web.archive.org/web/20170809101936id_/http://kimberlysheppard.wiki.westga.edu/file/view/Cognitive%20Neuroscience%20and%20education%20-%20unravelling%20the%20confusion.pdf/238874801/Cognitive%20Neuroscience%20and%20education%20-%20unravelling%20the%20confusion.pdf

Saah T. (2005). The evolutionary origins and significance of drug addiction. *Harm reduction journal*, *2*, 8. https://doi.org/10.1186/1477-7517-2-8

Saleebey, D. (1996). The Strengths perspective in social work practice: Extensions and cautions. *Social Work*, *41*(3), 296–305. http://www.jstor.org/stable/23718172

Seaward, B. (2022). *Managing Stress: Skills for Self-Care, Personal Resiliency, and Work-Life Balance in a Rapidly Changing World*. Tenth Edition. Jones & Bartlett Learning.

Siegel, D. (2011). *Mindsight: The new science of personal transformation*. Batam Books.

Siegel, D. (2020). Comprehensive Interpersonal Neurobiology Course. https://mindsightinstitute.com/product/the-mindsight-approach-to-well-being-a-comprehensive-course-in-interpersonal-neurobiology/

Society for Neuroscience (2017). This interactive brain model. https://www.brainfacts.org/3d-brain#intro=false&focus=Brain-cerebral_hemisphere-right

Substance Abuse and Mental Health Services Administration (1999). *Treatment for Stimulant Use Disorders*: Updated 2021. Treatment Improvement Protocol (TIP) Series, No. 33. https://www.ncbi.nlm.nih.gov/books/NBK576541/

Technology.org. (2014, September 10). Addiction Prevention: Essential Lesson Plans for K-12 Educators. Technology.org: Science and Technology News. https://www.technology.org/2014/09/10/addiction-prevention-essential-lesson-plans-k-12-educators/

Texas Education Agency (2023). *Texas school mental health: About the best practice list.* https://schoolmentalhealthtx.org/about-best-practice-list/

Texas Education Agency (2024). *Restorative Discipline Practice in Texas*. https://tea.texas.gov/texas-schools/health-safety-discipline/restorative-discipline-practices-in-texas#:~:text=Restorative%20Discipline%20Practices%20(RDP)%20in,in%20a%20statewide%20roll%20out.

Texas Education Agency (2024, March 14). *Mental & Behavioral Health Webinar Series*. https://schoolmentalhealthtx.org/webinars/

University of Laverne (2023). Drug Free Schools and Communities Act. https://laverne.edu/student-affairs/substance-abuse-

prevention/#:~:text=In%20response%20to%20former%20President,to%20receive%20federal%20financial%20assistance.

U.S. Department of Health and Human Services, National Institutes of Health, and National Institute on Drugs Abuse. *The Brain: Understanding Neurobiology Through the Study of Addiction.* (2010).

U.S Department of Health and Human Services. (2023, January 4). *SAMHSA Announces national survey on drug use and health (NSDUH) results detailing mental illness and substance use levels in 2021.* https://www.hhs.gov/about/news/2023/01/04/samhsa-announces-national-survey-drug-use-health-results-detailing-mental-illness-substance-use-levels-2021.html

U.S. Department of Education (2006). Office of Safe and Drug-Free Schools, Higher Education Center for Alcohol and Other Drug Abuse and Violence Prevention. *Complying With the Drug-Free Schools and Campuses Regulations [EDGAR Part 86]: A Guide for University and College Administrators,* Washington, D.C. https://safesupportivelearning.ed.gov/sites/default/files/hec/product/dfscr.pdf

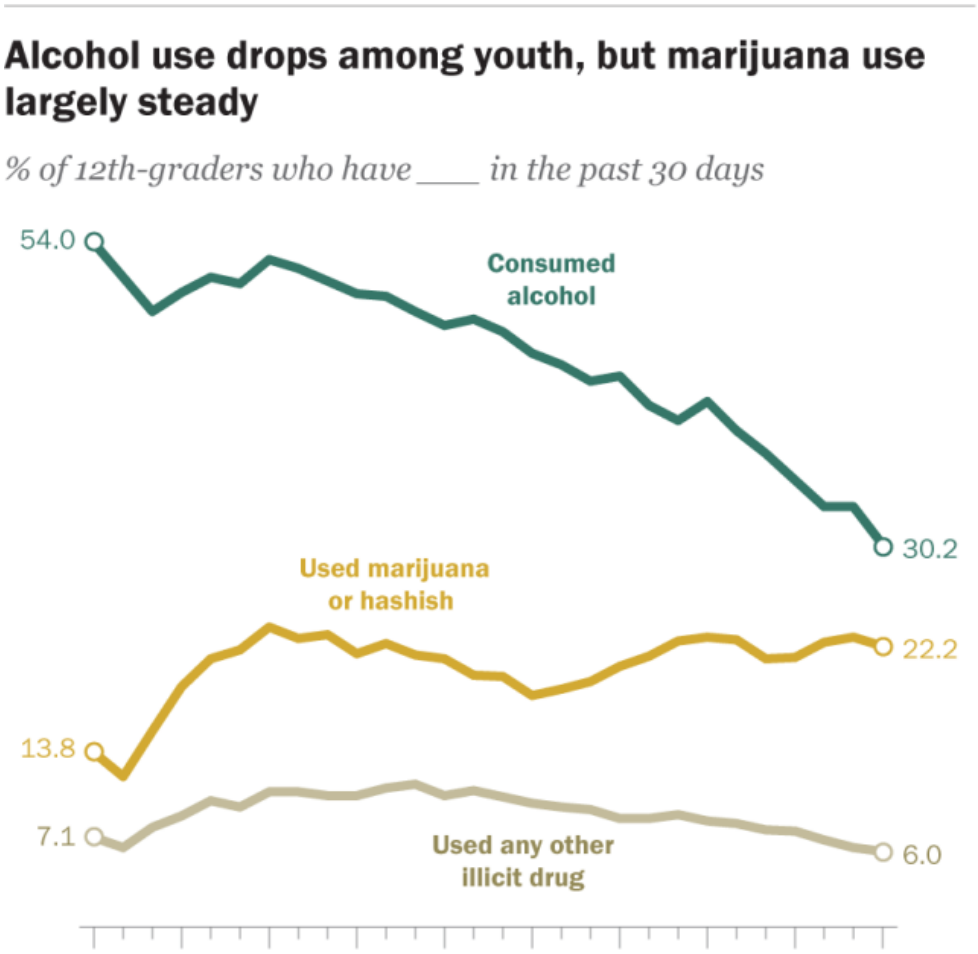
Vassoler, F. M., & Sadri-Vakili, G. (2014). Mechanisms of transgenerational inheritance of addictive-like behaviors. *Neuroscience*, *264*, 198–206. https://doi.org/10.1016/j.neuroscience.2013.07.064

Ventura, Alicia S. MPH; Bagley, Sarah M. MD. (2017, September/October). To improve substance use disorder prevention, treatment and recovery: Engage the family. *Journal of Addiction Medicine*. 11(5): p 339-341. DOI:10.1097/ADM.0000000000000331

Volkow, N. D., & Li, T. K. (2005). Drugs and alcohol: Treating and preventing abuse, addiction, and their medical consequences. *Pharmacology & Therapeutics*, *108*(1), 3-17. https://doi.org/10.1016/j.pharmthera.2005.06.021

Yorke, J. & Bergère, T. (2017). Where the rubber hits the road: Neuroscience and social work. Routledge. https://doi.org/10.1080/00981389.2017.1407861

Appendix A



(DeSilver, 2019)

Despite efforts in prevention, statistics shows that substance use is still one of the main problems teens are facing.

Appendix B

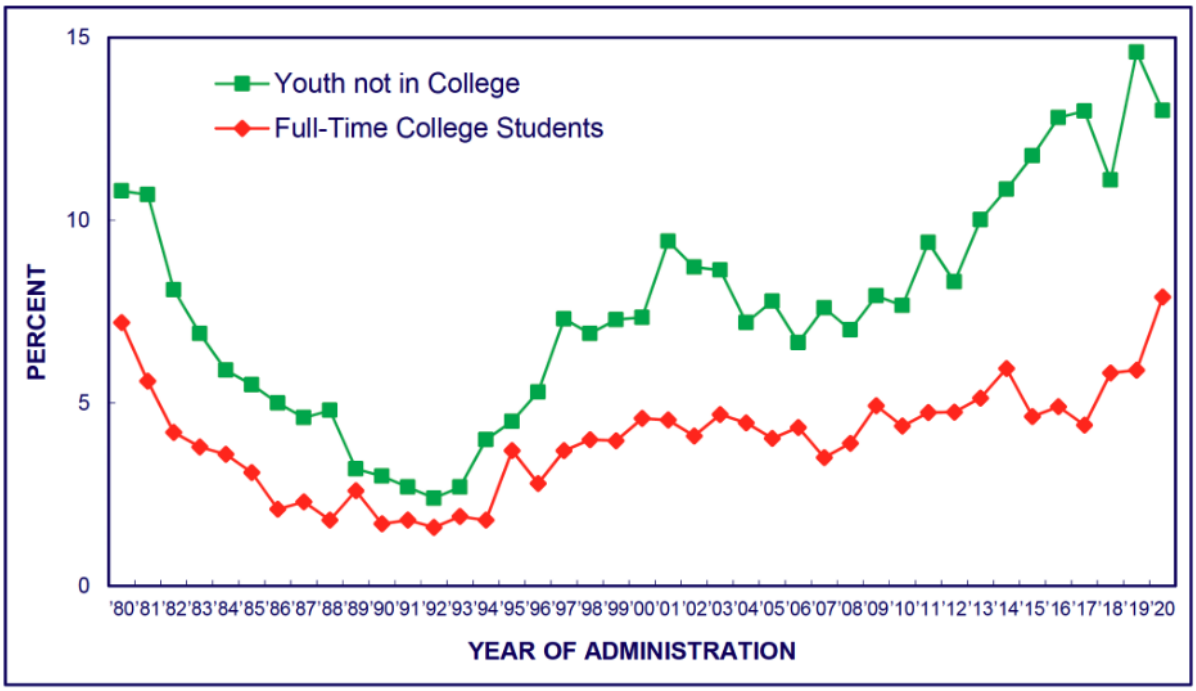


Figure 2, Marijuana, from Monitoring the Future national survey results on drug use, 1975-2020: Volume 2. Image credit: The Monitoring the Future study

Miech et al., (2023)

A summary of the report is found in the National institute of Health (2021):

> ***"Marijuana use:*** Annual marijuana use has continued to increase over the past five years for college students, reaching the highest level in over three-and-a-half decades in 2020. Among college students, 44% reported using marijuana in the past year in 2020, compared to 38% in 2015, representing a significant increase. For young adults not in college, annual marijuana use in 2020 remained at 43% (the same historically high level as recorded in 2018 and 2019)." (p. 1)