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Short-Term Brain-Based Growth Mindset Pilot Intervention Indicates Potential of Diversion Programs For Early Offenders in the Juvenile Justice System

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ABSTRACT: The goal of the present research was to determine if a Brain-Based Growth Mindset Pilot Intervention implemented in a juvenile detention facility could change a set of beliefs surrounding self-efficacy and knowledge over one's brain. Previous studies show that growth mindset interventions are most effective with youth from low socioeconomic households, and targeting changes in beliefs is particularly effective during adolescence because of the developmental milestones that accompany puberty. Detained juveniles tend to be adolescent minorities of low-income backgrounds with a higher number of adverse childhood experiences. Twenty-six detained juveniles participated in the pilot intervention. The intervention consisted offour, 30-minute lessons on neuroanatomy of the brain, neural plasticity, emotional regulation, and long-term neuronal development. Impact of the intervention was quantified by a Brain Health Intervention Scale (BHIS). The scale consisted of 31 affirm/deny statements that were designed to measure the knowledge gained or opinion changed by the participant about the brain.Analysis of pre- and post-intervention scores on the BHIS indicate that this pilot intervention was a success with significant increases in knowledge from pre-intervention scores to post- intervention scores. Success in the intervention was negatively correlated with the number of previous detainments. Interventions that occur within the context of juvenile detentions must occur early, before multiple detainments have made it difficult to reverse the fixed mindset in previously detained youth. Results add further evidence that successful growth mindset interventions can be low-cost and light-touch. Brain-based growth mindset interventions must beexplored early on as a diversion alternative for juvenile offenders.

KEYWORDS: juvenile detention, juvenile offenders, self-efficacy, emotional regulation,growth mindset intervention, diversion program

Finding an answer to both mitigating the effect of detainment on the mindset of low- income youth and reducing the juvenile recidivism rate is of major public health and economic implications (Peterruti, Velazquez, & Walsh, 2009). Most of the 100,000 detained juveniles in the United States are minorities of low-income backgrounds with a higher number of adverse childhood experiences (Holman & Ziedenberg, 2006; Peterruti, Velazquez, & Walsh, 2009). TheJustice Policy Institute compiled a report on the costs of diversion programs across the United States, and found that in New York City, a detention diversion program is 15x *less expensive* perday as compared to one day in detention (Holman & Ziedenberg, 2006). In addition, increases injuvenile detainment have not resulted in decreased crime in communities, indicating that detainment is not only detrimental to the mental health of the juvenile (Kashani et al., 1980; Stokes, McCoy, Abram, Byck, & Teplin, 2015), but also not effective at lowering crime rates (Holman & Ziedenberg, 2006). Evaluation of detention diversion programs is necessary to ensure they are cost-effective and supportive to juveniles.

The U.S. government designates that the goal of detainment in juvenile justice is to ensure public safety as well as "skill development, habilitation, rehabilitation, addressing treatment needs, and successful reintegrating of youth into the community" ("Juvenile Justice"). The juvenile justice system can provide incredible resources for struggling adolescents, allowing them to escape from household and social violence, and find necessary treatments for substance abuse, anger management, or mental illness (Ziedenberg, 2006). Diversion programs for detainedyouth have become more common in order to facilitate the goal of rehabilitation into the community. Many of these programs are new and evaluation of their success is extremely criticalto ensure it is beneficial to detained juveniles.

One common juvenile intervention program is a growth mindset intervention. A growth mindset is when a person believes that abilities can be fostered and cultivated, as opposed to a fixed mindset, in which a person believes that he or she is born with a certain amount of unchangeable ability (Paunesku et al., 2015). Growth mindsets are associated with a wide varietyof successful

outcomes in youth development (Yeager et al., 2019). Importantly, growth mindsetinterventions can be light-touch and low-cost, with highly successful outcomes, particularly among youth from under-resourced communities (Yeager at al., 2019; Sisk et al., 2018; Good, Aronson, & Inzlicht, 2013).

There have been many interventions aimed at helping juvenile offenders and detainees, but few have focused explicitly on growth mindsets. One such juvenile offender intervention program focused on "character education" and "moral development" in juvenile offenders (Seroczynski, Evans, Jobst, Horvath, & Carozza, 2016). In Seroczynski et al.'s 2016 study, non- violent, first-time juvenile offenders who were recommended for a detention diversion program were randomized into community service or into a program called Reading for Life (RFL). RFL placed the juvenile offenders in small discussion-based reading groups. The groups chose a novelto read and the 10-week program aimed to foster moral development by discussing and journaling on the chosen novel in the context of virtue theory. Although there was no explicit measure of a change-in-mindset, when compared to the 214 control participants, recidivism was reduced by 10% in the 194 RFL intervention participants. Like most growth mindset interventions, the program was most efficacious for the groups of juveniles who are historically at the highest risk of recidivism: juvenile males of a low socioeconomic status, and juvenileswho are a member of a minority racial group.

The Brain-Based Growth Mindset Pilot Intervention studied here was implemented with detained juveniles. The intervention aimed to adjust a set of beliefs surrounding self-efficacy andgrowth mindset in the context of how one's brain functions. This study was done at the St.

Joseph Juvenile Justice Center; a detention center and probate court for a mid-size county in Indiana. This study consisted of four, 30-minute lessons on neuroanatomy of the brain, neuralplasticity, emotional regulation, and long-term neuronal development.

This study chose to recruit participants at the St. Joseph Juvenile Justice Center in order to specifically target adolescents from under-resourced communities that may benefit the most from growth mindset diversion programs. Growth mindset interventions are most effective with youth from low socioeconomic households (Yeager at al., 2019; Sisk et al., 2018; Good, Aronson, & Inzlicht, 2013). Furthermore, targeting changes in beliefs is particularly effective during adolescence because of the developmental milestones that accompany puberty (Yeager etal., 2019). The stated purpose of detention at the St. Joseph Juvenile Justice Center is "to ensure public safety…while balancing the best interests of the juveniles and the needs of their families, as well as recognizing the value and potential of each individual" ("Detention: St. Joseph County"). This study provides an evaluation of a small pilot intervention that has the potential tobe expanded into a complete diversion alternative for juvenile offenders. Data for this study wascollected using a 31-statement affirm/deny scale in order to test specific beliefs that changed over the four-lesson course. This study predicted that in general, scores on the Brain Health Intervention Scale (BHIS) before and after the Brain-Based Growth Mindset Intervention wouldincrease.

METHODS AND MATERIALS

The present study took place at the St. Joseph Juvenile Justice Center (JJC), where all participants were detained for the duration of the intervention. Demographic information was collected on all participants. Each participant was given a 31-statement affirm/deny scale prior tothe four, 30-minute lessons that focused on neuroanatomy, emotional regulation, neural plasticity, and long-term neuronal development. The four lessons took place during a two-week period, and after completion of the lessons, the same 31-statement scale was given to each participant again. The intervention took place within small cohorts ranging from 3-8 participants, separated by sex.

Participants

Twenty-six participants were recruited through the St. Joseph Juvenile Justice Center (JJC). Information on age, gender, number of adverse childhood experiences (ACE), number of previous detainments on their juvenile record, highest offense crime filed against the juvenile, and race/ethnicity were collected on each participant. Sample characteristics for the interventiongroup are in Table 1. There were 26 juveniles in the intervention with an average age of 15.85 with a standard deviation of 1.22. The intervention group had 17 males and nine females. The intervention group was comprised predominantly of juveniles from a racial minority: twenty juveniles were African American or Hispanic, and six juveniles were White. Fifteen of the juveniles had a felony in their juvenile record, while nine had a misdemeanor as their highest offense level ever filed against them in their record. There were two juveniles whose highest- offense level could not be obtained—one because the juvenile lived outside of the county and was placed as a courtesy hold in the JJC, and one because no offense had yet been filed against the juvenile. The juveniles had an average of three previous detainments, with a standard deviation of 1.63, and an average score of 5.56 out of 10 adverse childhood experiences, with a standard deviation of 2.65. The ACE scale was conducted upon intake into the facility by a socialworker. The ACE scale used was from the original 1998 Kaiser Permanente ACE Study. One juvenile did not have an ACE score on file.

There were no exclusionary characteristics. If the participant was detained for the duration of the intervention, then he or she could participate in the research study. There were three detainees that could not participate because they had privileges revoked for bad behavior. Steps were taken to obtain parental consent in person, by phone, or by an appointed Guardian AdLitem when applicable. If the parent could not practicably be contacted, parental consent was waived per the IRB Protocol. There was no randomization

process within juvenile detention, meaning if the participant was competent, and appropriate assent by the minor was obtained, then the participant could participate. Each participant provided assent to participate in the research study. All study methodology was approved by the Institutional Review Board for Protection of Human Subjects in Research at the University of Notre Dame (Protocol # 17-04- 3840).

Table 1. Sample Characteristics for Intervention Group.

Characteristic	
Age (N=26)	15.85 (1.22)
Women (N=26)	34.61%
Race (N=26)	
African American or Hispanic	76.92%
White	23.08%
Highest offense level filed (N=24)	
Misdemeanor	37.50%
Felony	62.50%
Number of previous detainments (N=26)	3.00 (1.62)
ACE Score (N=25)	5.56 (2.65)

Brain Health Intervention Scale (BHIS)

The Brain Health Intervention Scale (BHIS) was developed by the research team in conjunction with the Center for Social Research at the University of Notre Dame. The scale consisted of 31 affirm/deny statements that were designed to measure the knowledge gained or opinion changed by the participant about the brain (Appendix B). The statements always occurred in the same order and there was one statement used to determine the validity of the scale. If the participant failed the validity check, then his or her scales were discarded. This occurred with two participants. The other 30 statements were divided into 4 attributes that reflected the 4 sessions within the course: neuroanatomy/function, emotional regulation, neural plasticity, and long-term neuronal development. On the BHIS, there were 4 statements on neuroanatomy/function, 7 statements on emotional regulation, 6 statements on neural plasticity, and 13 statements on long-term neuronal development. The scale had approximately a 6th grade reading level according to the Flesch-Kincaid Grade Level. Each participant was assigned an IDnumber to ensure the confidentiality of the participant. Each participant was given a pencil, instructed to write their participant ID, and then circle “yes” or “no” to indicate whether the participant agreed with the statement. The participants completed the scale individually. Each participant was given a pencil, assigned a participant ID, and instructed to circle the statement ifhe or she agreed with it. The participants were given approximately 15 minutes to complete the scale.

One researcher went to the St. Joseph Juvenile Justice Center on Monday, Wednesday, and Friday (M/W/F) mornings from August, 2017 – March, 2018. The pre-scale was conductedon the M/W/F prior to the start of the course, while the post-scale was conducted on the M/W/Fimmediately following the last session in the course.

Content of the Brain-Based Growth Mindset Intervention

The course consisted of four, 30-minute lessons on M/W/F mornings. Each lesson focused on one specific attribute of brain-based knowledge and had a specific learning goal forthat lesson (Table 2). See Appendix A for detailed instructions on how each lesson was conducted.

Table 2. Learning goal for each of the four lessons in the Brain-Based Growth Mindset Intervention.

Lesson	**Learning Goal**
1 – Neuroanatomy/Function	Be able to identify three brain structures that create and/or regulate emotion: nucleus accumbens, pre- frontal cortex (PFC), and amygdala. Understand thefunctional role of each structure.
2 – Emotional Regulation	Develop the ability to identify how one is feeling. Recognize how the balance between the PFC and amygdala function determines one’s behavioral andemotional response.
3 – Neural Plasticity	Understand how the brain is constantly changing the connections between the PFC and amygdala. Recognize the concept of neural plasticity and thatevery choice changes the brain.
4 – Long-Term Neuronal Development	Evaluate long-term goals and how those align with certain types of behavior (i.e. not coming back to theJJC). Establish the idea of choice in behavior and resultant outcomes.

Analytic Strategy

Results were analyzed using RStudio Version 1.2.1335. The overarching objective of data analysis was to determine if there were any significant changes in the score on the Brain Health Intervention Scale before and after the intervention. Statistical analyses were run to determine if there were any significant changes in the score that varied according to sample characteristics: age, gender, highest offense level filed, ACE score, number of previous detainments, and race. Binary characteristics (gender, offense level (misdemeanor or felony), andrace (racial minority or white) were analyzed using a t-test between the two groups. A one-way analysis of variance was performed to determine if there were statistically different contributionsto the increases in score, depending on the four attributes (neuroanatomy/function, emotional regulation, neural plasticity, and long-term neuronal development). Continuous characteristics (age, ACE score, and number of previous detainments) were analyzed using correlation statistics.

RESULTS

A paired t-test between pre- and post- intervention scores on the Brain Health Intervention Scale indicated post-intervention scores (M = 23.42, SD = 7.23) were significantlygreater than pre-intervention scores [M = 15.12, SD = 7.17; t(25) = 8.44, p<0.001; Figure 1].

A t-test of unequal variance that compared changes in the score on the Brain Health Intervention Scale between racial minorities (M=7.25, SD=3.54) and racial non-minorities found no significant difference (M=11.83, SD=7.68; t(5.651) = 1.42, p = 0.21). A t-test of unequal variance that compared changes in the score on the Brain Health Intervention Scale between women (M=10.11, SD=6.77) and men found no significant difference (M=7.35, SD=3.69; t(10.58) = 1.136, p = 0.28). A t-test of unequal variance that compared changes in thescore on the Brain Health Intervention Scale between juveniles with misdemeanors (M=7.89 SD=2.37) and juveniles with felonies found no significant difference (M=7.33, SD=3.96;t(21.99) = 0.43, p = 0.67).

A one-way ANOVA found a significant effect on change in score by lesson attribute-- neuroanatomy/function, emotional regulation, neural plasticity, and long-term neuronal development (F(3, 100) = 13.55, p<0.001). A Tukey HSD Post-Hoc analysis found a significantly greater impact on score for the neuroanatomy attribute as compared to emotional regulation (p<0.001), neural plasticity (p<0.01), and long-term neuronal development (p<0.001;Figure 2).

For the continuous characteristics (age, ACE score, and number of previous detainments),Pearson's correlation test was performed. No significant correlation was found between increase in score on the intervention scale and age nor increase in score on the intervention scale and ACE score. A significant correlation (R = -0.348) was found between change in score on the intervention scale and number of previous detainments (t(24) = 1.82, p = 0.08; Figure 3).

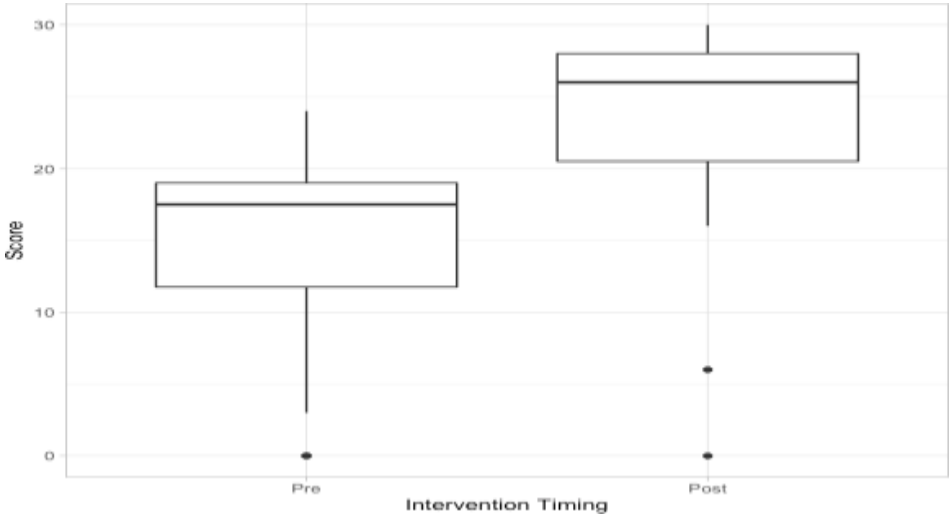

Figure 1. Pre-intervention and post-intervention scores on the Brain Health Intervention Scale. Paired t-test indicated post-intervention scores (M = 23.42, SD = 7.23) were significantly greater than pre-intervention scores [M = 15.12, SD = 7.17; t(25) = 8.44, p<0.001].

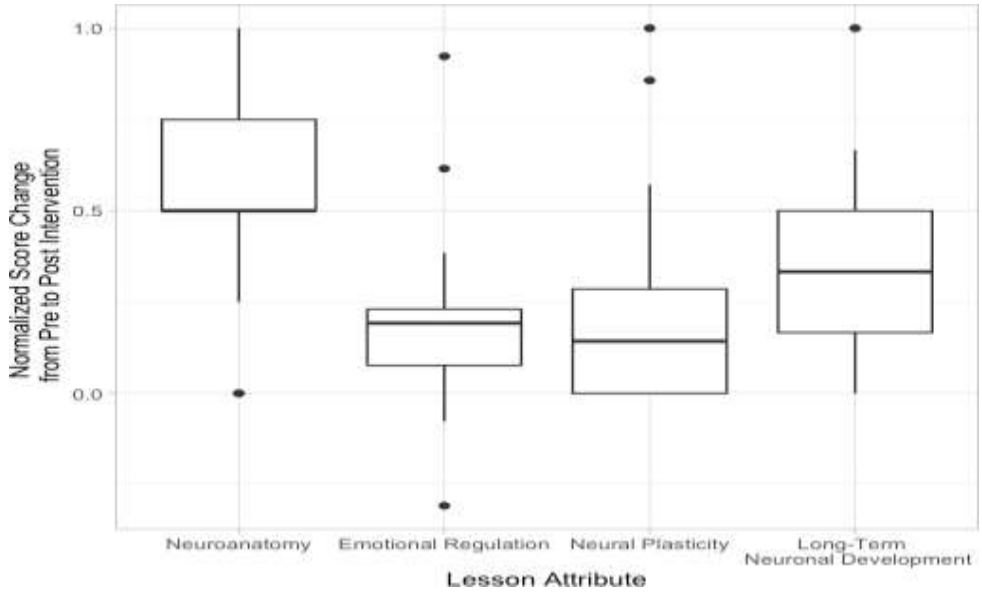

Figure 2. Normalized score differentials between pre- and post-intervention scale for juveniles by four interventionattributes. To account for the different number of statements pertaining to each attribute, statements was normalizedby dividing the score differentials by the number of statements on the BHIS within each attribute, resulting in a fraction. A one-way ANOVA found a significant effect on change in score by lesson attribute-- neuroanatomy/function, emotional regulation, neural plasticity, and long-term neuronal development ($F(3, 100) = 13.55$, $p<0.001$). A Tukey HSD Post-Hoc analysis found a significantly greater impact on score for the neuroanatomy attribute as compared to emotional regulation ($p<0.001$), neural plasticity ($p<0.01$), and long-term neuronal development ($p<0.001$).

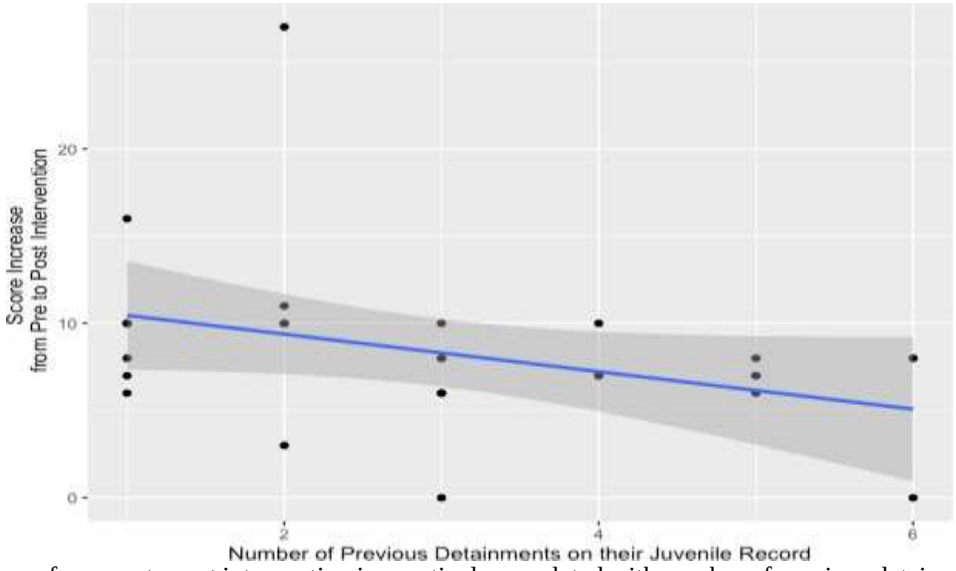

Figure 3. Score increase from pre to post intervention is negatively correlated with number of previous detainmentson their juvenile record. The blue line indicates the best fit line, while the gray shaded area indicates the standard error of the best fit line. A significant correlation ($R = -0.35$) was found between change in score on the interventionscale and number of previous detainments ($t(24) = 1.82$, $p = 0.08$).

DISCUSSION

The goal of the present research was to determine if a novel Brain-Based Growth MindsetPilot Intervention implemented in a juvenile detention facility would change a set of beliefs surrounding self-efficacy and knowledge over brain development. Analysis of pre- and post- intervention scores on the BHIS indicate that this intervention was a success with significant increases in knowledge from pre-intervention scores to post-intervention scores. Success in the intervention was negatively correlated with the number of previous detainments. Overall, juveniles scored significantly greater on questions about neuroanatomy on the BHIS, as compared to every other section.

The success of the pilot intervention in a small sample indicates that the juveniles were able to retain significant knowledge gains from only a 4-week intervention, adding further evidence that successful growth mindset interventions can be low-cost and light-touch. Althoughthe intervention was successful overall, it is most fascinating to see a negative correlation between success in the intervention and number of previous detainments. This finding is in agreement with one result of Seroczynski's 2016 study on a diversion program implemented in the St. Joseph Juvenile Justice Center called "Reading for Life," which found in its pilot trial thatthe virtue-theory-informed reading program would have the most impact on recidivism rates in first-time offenders, rather than juveniles who already had history with the justice system (Seroczynski, Evans, Jobst, Horvath, & Carozza, 2016). The study hypothesized that juveniles who already had a history with the justice system may be "jaded." In other words, after multiple detainments, juveniles tend to gain a fixed mindset, labeling themselves and becoming labeled by society as "delinquents" who cannot be "saved" by a short-term intervention or other diversion program. Interventions that occur within the context of juvenile detentions must occur early, before multiple detainments have made it difficult to reverse the fixed mindset in thepreviously detained youth.

The current study and the moral-development program in the Reading for Life intervention, which was specifically aimed at adjusting the mindset of first-time offenders, point to the need for diversion programs that occur early (before multiple detainments) and involve a growth mindset aspect. It is possible that multiple detainments damage the mindset of the juvenile, causing them to believe that he or she is a "delinquent" incapable of change, thus possibly rendering short-term intervention programs ineffective after a juvenile has undergone multiple detainments (Holman & Ziedenberg, 2006). Evidence of the mental damage correlated with detainments comes from a high prevalence of depression within juveniles who are detained and after juvenile offenders are released, as well as high rates of suicidal ideation (Kashani et al.,1980; Stokes, McCoy, Abram, Byck, & Teplin, 2015). Studies also indicate that detained juveniles are more likely to have emotional disturbances (Pincham, Bryce, & Pasco Fearon, 2015; Underwood & Washington, 2016). It is vital to study the effect of diversion programs, particularly in first-time offenders, in order to determine effective, evidence-based solutions to juvenile crime that mitigate recidivism and lessen the damage to the adolescent mind.

As stated, juveniles scored significantly greater on questions about neuroanatomy on the BHIS, as compared to every other section. There are a few reasons why this could have happened. Neuroanatomy was the first lesson that was taught, and the knowledge taught in this section was applied in the three subsequent lessons. Thus, juveniles had the most exposure to the information contained in the lesson on neuroanatomy, as well as the most practice applying that knowledge to the other concepts in the subsequent lessons. This indicates the need for more application-based content in the intervention

LIMITATIONS

The largest limitation of this pilot intervention is the study's small sample size. The studysample was small because the average length of detainment is 15 days before the juvenile is either sent home, sent to a residential treatment facility, or sent to a long-term detainment center (McCord, Widom, & Crowel1, 2001) This length of stay is not long enough for the 4-week intervention, so there were many juveniles who were not detained long enough to complete the intervention. Further studies should focus on interventions that are short, yet impactful and can be completed with a large number of detainees, or explore the possibility of more intensive detention diversion programs that enable the expansion of brain-based education and development.

Another limitation is the timing of the post-intervention scale. Ideally, juveniles would betested again weeks or even months after the intervention to ensure the knowledge gains were retained. This is less feasible in a juvenile detention population because of parent's distrust of thejustice system and lack of cooperation for a post-treatment survey on their child. Future studies should push beyond this barrier and attempt to survey youth weeks after completion of the intervention, as well as follow up on any academic or socio-emotional changes in the post- intervention period.

Lastly, the scale used in this study can be improved upon in future studies. The scale wasdesigned specifically for use in this pilot study. No other study has implemented a growth- mindset intervention in the context of brain-based knowledge. Unfortunately, the use of dichotomous questions lends itself to the social desirability affect. However, a validity statementwas used ("I understand what the cortical homunculus is.") in order to determine if the participant was simply affirming all statements in accordance with the social desirability affect.

CONCLUSION

This pilot study is part of a larger movement in the juvenile justice system that is pointingthe system towards the use of diversion programs. The Juvenile Detention Alternatives Initiative (JDAI) began in the 1990s to find alternative intervention strategies for delinquent youth to "reduce reliance on local confinement of court-involved youth" in an effort to lower recidivism rates and increase the future success of detained youth (The Annie E. Casey Foundation, 2019). The strategies of the brain-based growth mindset intervention presented here are in direct alignment with the stated goals of the JDAI, and results of this study suggest a possible strong component to a JDAI alternative model..

Implementation of a diversion program that incorporates brain-based knowledge similar to the content of this intervention may be beneficial not only for the juvenile but also for the community. Future studies must explore the long-term effectiveness of such a diversion program,including the effects on a juvenile's mental well-being and future success, as well as potential economic and public health benefits.

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Appendix A

Detailed Content of Brain-Based Growth Mindset Intervention

The first lesson focused on neuroanatomy and functions of the brain, specifically, the locations of the nucleus accumbens (NAcc), the amygdala (AM), the prefrontal cortex (PFC), and their functions. The lesson began by playing the song "Dear Mama" by Tupac

(Tupac, 1995), and the feelings that the song invoked were discussed. "Dear Mama" was chosen becauseit is a song about a young, African American man struggling with his relationship with his mother, similar to many of the juveniles. This provided an opportunity to explain the basic process of perception of music in order to give the participants a basic understanding of the function of a neuron. Pictures of a neuron and a map of the brain that showed the neuroanatomical locations of the NAcc, AM, and PFC were passed around the room (Appendix C). The lesson ended with a discussion of the connections between the NAcc, AM, and PFC, andsituations in which those connections are highly activated. The participants were then asked to talk about something that makes them angry, and then the feeling of anger was explained within the context of the NAcc, AM, and PFC. The main learning goal of this first lesson was to be ableto identify the NAcc, AM, and PFC, and their functional roles in the context of behavior.

The second lesson focused on emotional regulation. The lesson started by playing the song "I" by Kendrick Lamar (Lamar, 2014), and neuroanatomy and function from the first lessonwas reviewed, again using perception of music as a tool to explain the function of a neuron and neural processing. The physiological aspects of feelings, i.e. increased breathing rate and heart rate in contexts of exercising versus contexts of being searched by the police, were talked about. How to recognize when you are feeling angry or upset, and how to control acting out on that anger by using the connections among the NAcc, AM, and PFC was discussed. Skills and tactics to control anger, such as distracting oneself by counting or reciting the lyrics to a favorite song, were debated. How utilizing these skills to regulate emotions can change one's life was examined. Each participant was then asked to utilize these skills in interactions with staff or other juvenile offenders prior to the next lesson, and to keep note of the incident in order to share with the group in the next lesson. This lesson not only focused on emotional regulation strategies, but also on applying those strategies to specific situations in the participant's life to provide an example of practical implementation. It is not uncommon for there to be conflicts among the juveniles or between staff and juveniles. By working through emotional regulation strategies, it was hoped that in the next conflict, the participant would count to ten in his or her head, or start reciting the lyrics to a favorite song, instead of reacting emotionally. The first goal of this second lesson was to develop the ability to identify which emotion one is feeling, based on physiological clues. The second goal was to identify skills and techniques to shift the control of emotion towards the PFC and away from the amygdala.

The third lesson focused on neural plasticity. The lesson began by discussing one incidentthat occurred since the last class in which the participant employed some of the emotional regulation techniques discussed in the previous lesson. The concept of neural plasticity was explained, and then a short video by USC Stevens Neuroimaging and Informatics Institute was shown of neurons making new connections (USC Stevens Neuroimaging and Informatics Institute, 2017). The participants were asked to think of this video when they are angry or upset, and to think about the new connections in the brain that are made when the participant makes decisions out of anger versus employing strategies discussed during the lessons. The video and discussion introduced the idea of a cyclical connection between brain and behavior—when behavior changes, so does the brain, and when the brain changes, behavioral change necessarily follows. The idea that each of the participant's brains formed in interaction with their environment and neighborhood was introduced. The effect that parents can have on the brain of their child was discussed. The concept of the "window of opportunity" that adolescents and teenscan take advantage of in terms of neural plasticity was examined. Participants were asked to make one emotionally-related goal for once they're released from detainment that would be shared in the next lesson. Examples include: to be nicer to his/her mother, to act out less in school, or to remain calm during the next conflict with a police officer. The goal of this third lesson was for the participants to understand the constantly changing connections in the brain, particularly among the NAcc, AM, and PFC, and how these changing connections can influence their behaviors.

The fourth lesson focused on long-term neuronal development and having a future- oriented mindset. The first discussion in this lesson was on the emotionally-related goal that eachparticipant made in the previous lesson. This served to review what was learned about neural plasticity in the previous lesson, and to put neural plasticity into the context of long-term goals and a future-oriented mindset. Next, the participants discussed the decisions and behaviors that led to their detainment. How these decisions change the connections within the brain via the brain-behavior cyclical connection was reviewed. The brain-behavior cyclical connection was emphasized as well as the window of opportunity that each participant has to form their brain into a brain they want that makes positive decisions. Role models were discussed and each participant was asked to name a role model of theirs in terms of brain development, e.g. a personwhose behavior, and therefore brain, the participant would like to emulate. How each participant has a choice in their behavior was discussed, and therefore a choice in the connections in their brain and who they turn out to be as well. The emotional regulation techniques discussed in the second lesson were reviewed, and the shift away from the AM and towards the PFC that occurs when these techniques are employed. How employing these techniques may be difficult at first was emphasized, and then the concept of impulsiveness was talked about. How these new techniques could soon become second-nature as the connections in the participant's brain changed to accommodate these new behavioral and thought techniques was discussed. The goal of this lesson was to review and emphasize the connections across the three previous lessons, andto establish the idea of being future-oriented and goal-oriented.

Appendix B

Brain Health Intervention Scale

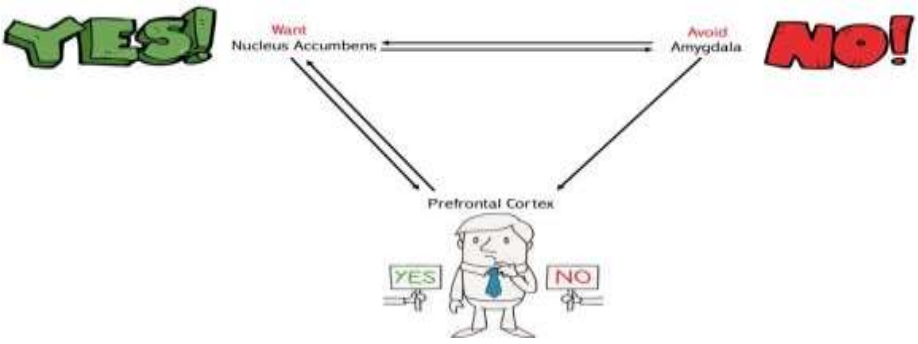
Instructions*:* Circle the numbers for sentences you believe to be true.

1. I understand what a neuron does. [Neuroanatomy]
2. I understand what the nucleus accumbens does. [Neuroanatomy]
3. I understand what the prefrontal cortex does. [Neuroanatomy]
4. I understand what the amygdala does. [Neuroanatomy]
5. I understand the relationship between the amygdala, prefrontal cortex, and nucleus accumens.[Neural Plasticity]
6. I understand what the cortical homunculus is. [VALIDITY CHECK]
7. I understand how the brain creates emotions. [Emotional Regulation]
8. I know my emotions. [Emotional Regulation]
9. Some emotions feel the same. For example, you may feel both excited and nervous before you goon a roller coaster. You can confidently say you are able to distinguish between emotions. [Emotional Regulation]
10. I am able to distract myself when I am upset, so that I don't act out my anger. [EmotionalRegulation]
11. I understand how my emotions now might affect who I grow up to be later. [EmotionalRegulation]
12. I know what neural plasticity is. [Neural Plasticity]
13. The environment in which I grew up shaped my brain. [Neuronal Development]
14. I think my brain changes due to my behavior. [Neuronal Development]
15. I think my brain is constantly changing. [Neuronal Development]
16. Everyone has a different brain. [Neuronal Development]
17. My brain would be different if I grew up in a different setting. [Neuronal Development]
18. I can control my emotions. [Emotional Regulation]
19. I can change the connections in my brain. [Neural Plasticity]
20. I want strong connections in my brain between the amygdala and the prefrontal cortex. [NeuralPlasticity]
21. My behavior is determined by the connections that exist in my brain. [Neuronal Development]
22. The decisions I make align with whom I want to be when I grow up. [Neuronal Development]
23. I have control over my future because I have control over my brain. [Neuronal Development]
24. I understand how my brain and behavior led me to the JJC. [Neuronal Development]
25. I can stop myself from acting out by distracting myself when I get upset. [NeuronalDevelopment]
26. I know what type of behavior it takes to do stay out of here. [Neuronal Development]
27. I can choose my behaviors so that I don't come back to the JJC. [Neuronal Development]
28. Every decision I make either strengthens or weakens connections in my brain. [Neural Plasticity]
29. If I line up my behavior with the behavior it takes to stay out of here, I will change the connections in my brain. Eventually, this behavior will be easier and I will never come back here.[Neural Plasticity]
30. I have control over my brain. [Neuronal Development]
31. I have a choice in the person I grow up to be because I have a choice in the connections in mybrain. [Neuronal Development]

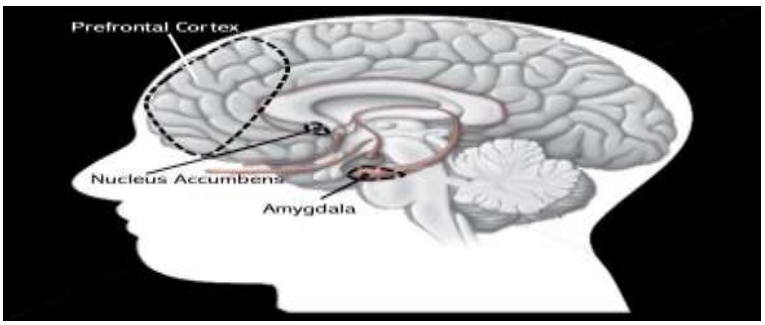
Appendix C

Images Used in Lesson on Neuroanatomy and Function

1) ("Neuron")



2) ("Business man choice vector illustration on blue background")



3) ("The brain's reward center," 2011)