

**ACADEMICS, EXECUTIVE
FUNCTIONING, AND FITNESS:
WHAT PULLS THESE TOGETHER AS
IMPORTANT FOCAL ISSUES FOR
EDUCATION AND COMMUNITY?**

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WHAT IS EXECUTIVE FUNCTIONING?

- Prefrontal cortex circuitry



Conducts the orchestra

- Supervisory control of cognitive functions to achieve a goal (Eslinger, 1996; Lezak et al., 2004)

- response inhibition, self-control
- allocation of attention and memory
- planning and carrying out activity sequences that make up goal-directed behavior
 - skillful and flexible use of strategies
 - goal-setting
 - self-monitoring



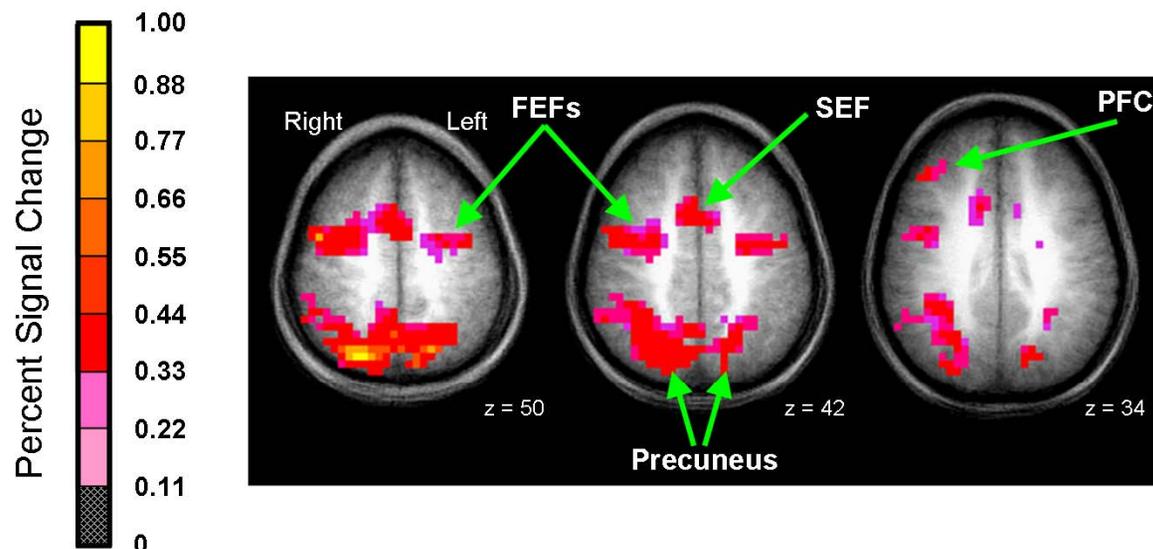
WHY DO WE BELIEVE THAT EXECUTIVE FUNCTIONING IS AFFECTED BY EXERCISE?

- “Executive functioning is more sensitive than other aspects of cognition to aerobic exercise training.”
(Colcombe & Kramer, 2003, as cited in Davis et al., p.4, in press)
- Overweight is associated with poorer achievement.
(Castelli et al., 2007 and more)
- Research examining the absence of PE in schools in favor of more classroom time for reading and math indicates that the extra time didn’t make a difference in academic test scores. (Dwyer, et al., 1983; Sallis et al., 1999; Shephard et al., 1984)

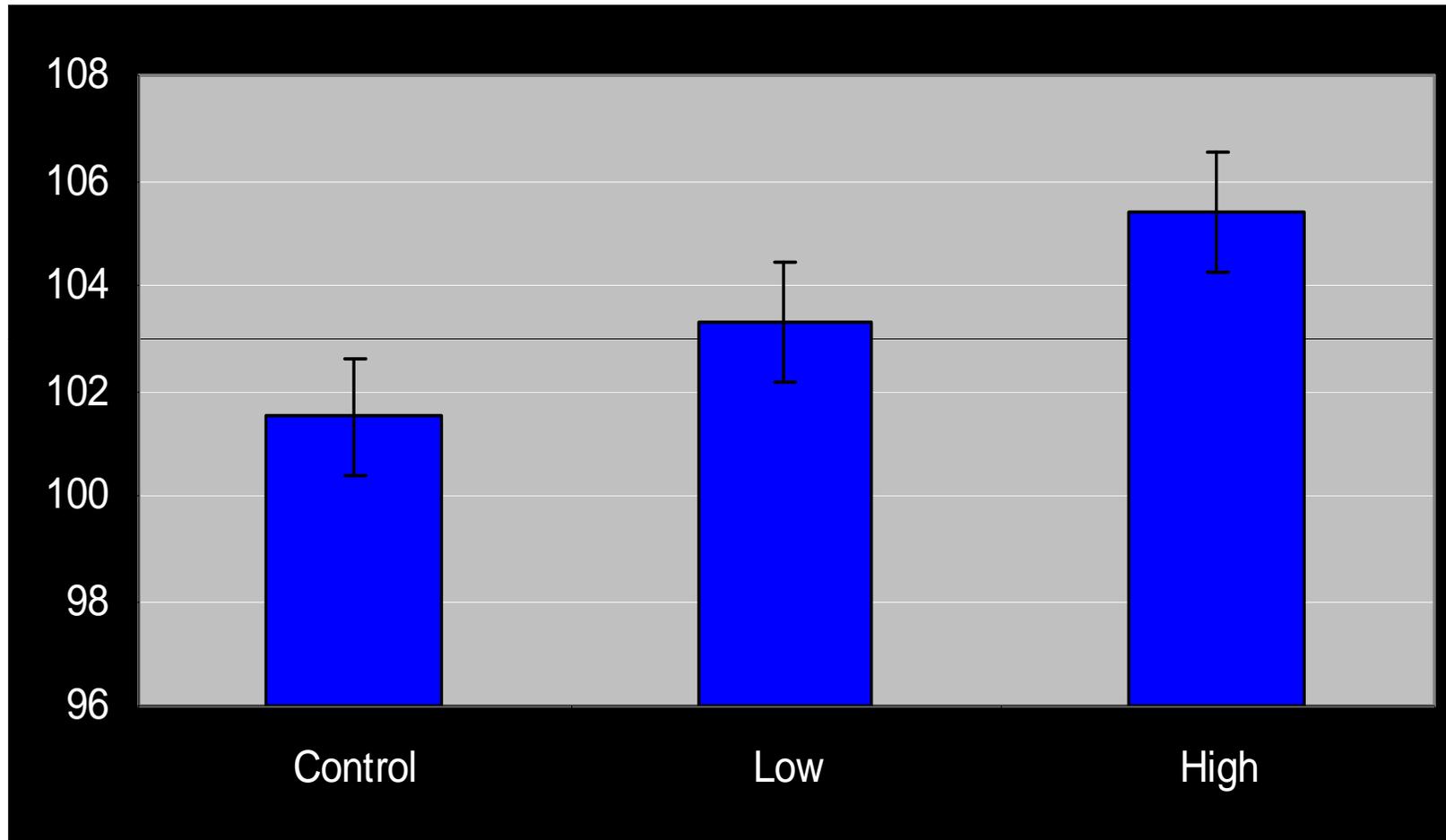


PLAY DATA

- Indicates the following:
 - A dose-response effect was found on Planning and Broad Math scales, indicating that exercise did likely improve executive functioning and math.
 - fMRI testing indicated more activity posttest in the exercise group in the areas of the brain that correspond to executive functioning.



EFFECT ON PLANNING

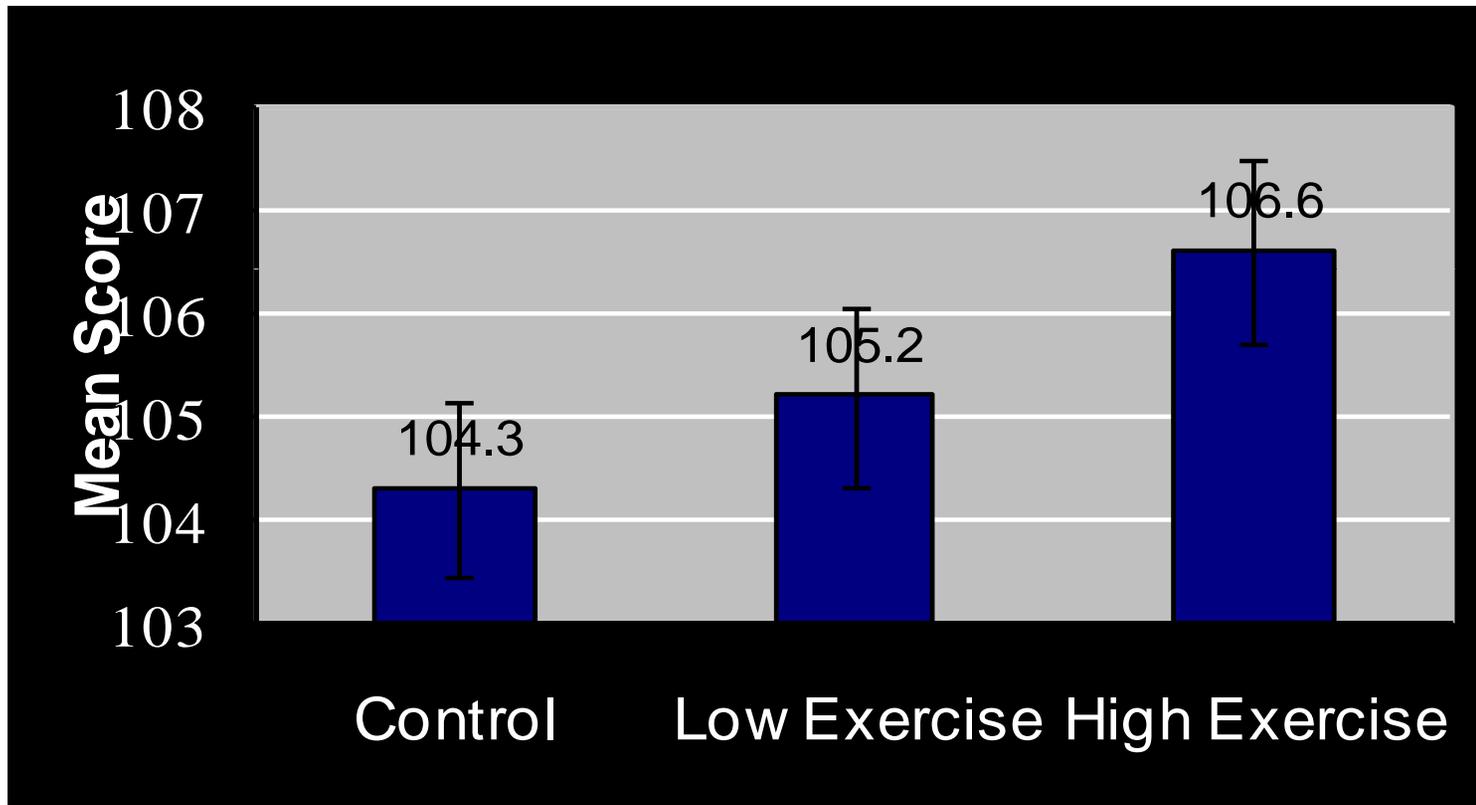


Posttest means \pm SE adjusted for sex, parent education, pretest.

CL Davis et al. Res Quart Exerc Sport, Dec. 2007; Tomporowski et al., Ed Psych Review 2007; Davis et al., Health Psychology, accepted



ACHIEVEMENT: BROAD MATH



Posttest means \pm SE adjusted for race, parent education, pretest.

CL Davis et al., Health Psychology, accepted



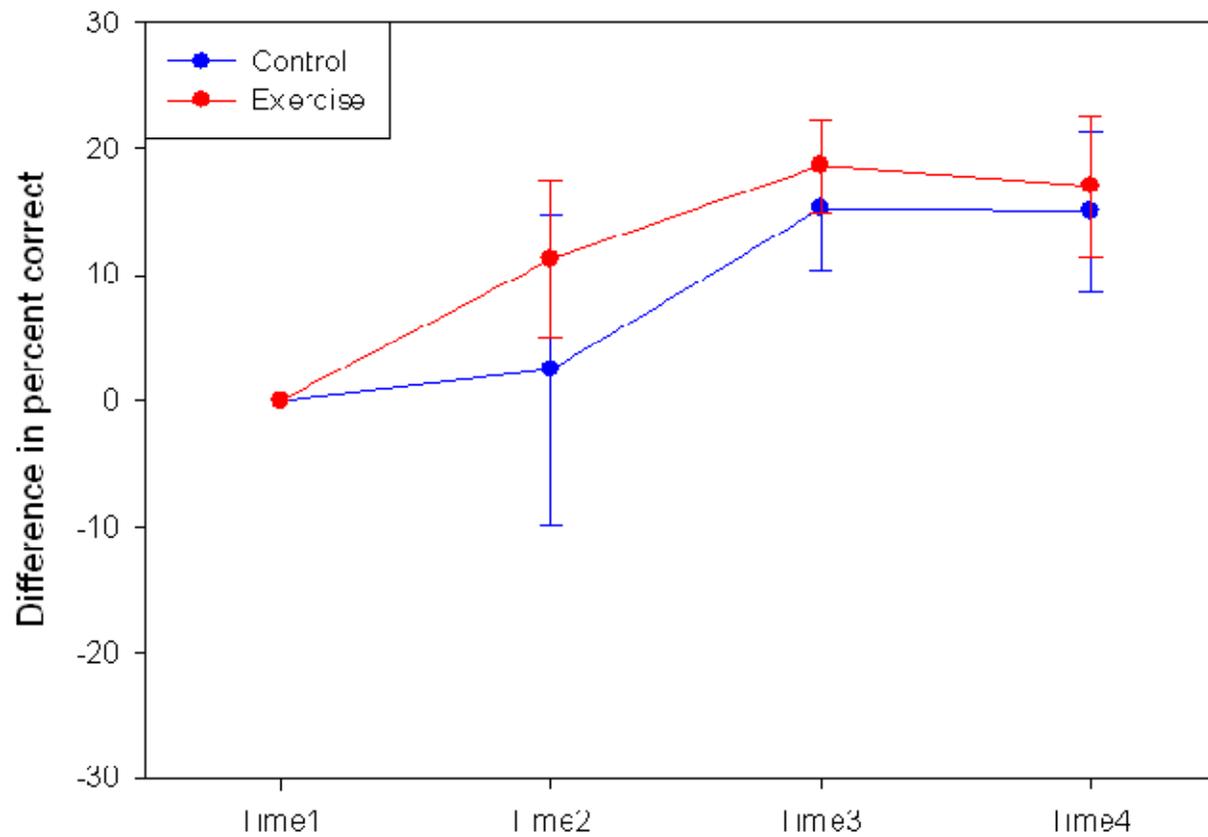
SMART DATA

- The SMART Study is a follow up study to the PLAY Study attempting to isolate exercise as the cause of improved cognition.
- Some evidence has indicated group differences thus far in our eyetracker task, which requires inhibition of a response (executive functioning task).



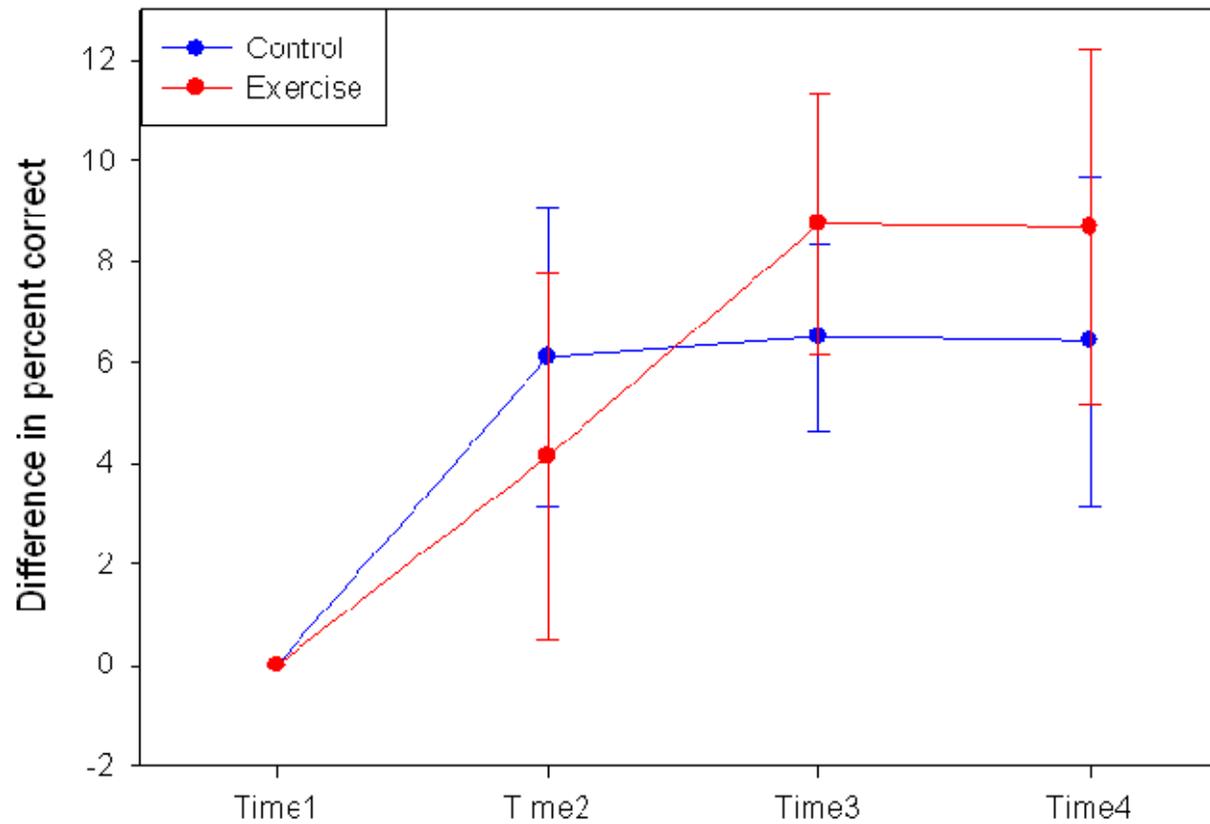
DIFFERENCE IN PERCENT CORRECT

Antisaccade: Difference in Percent Correct



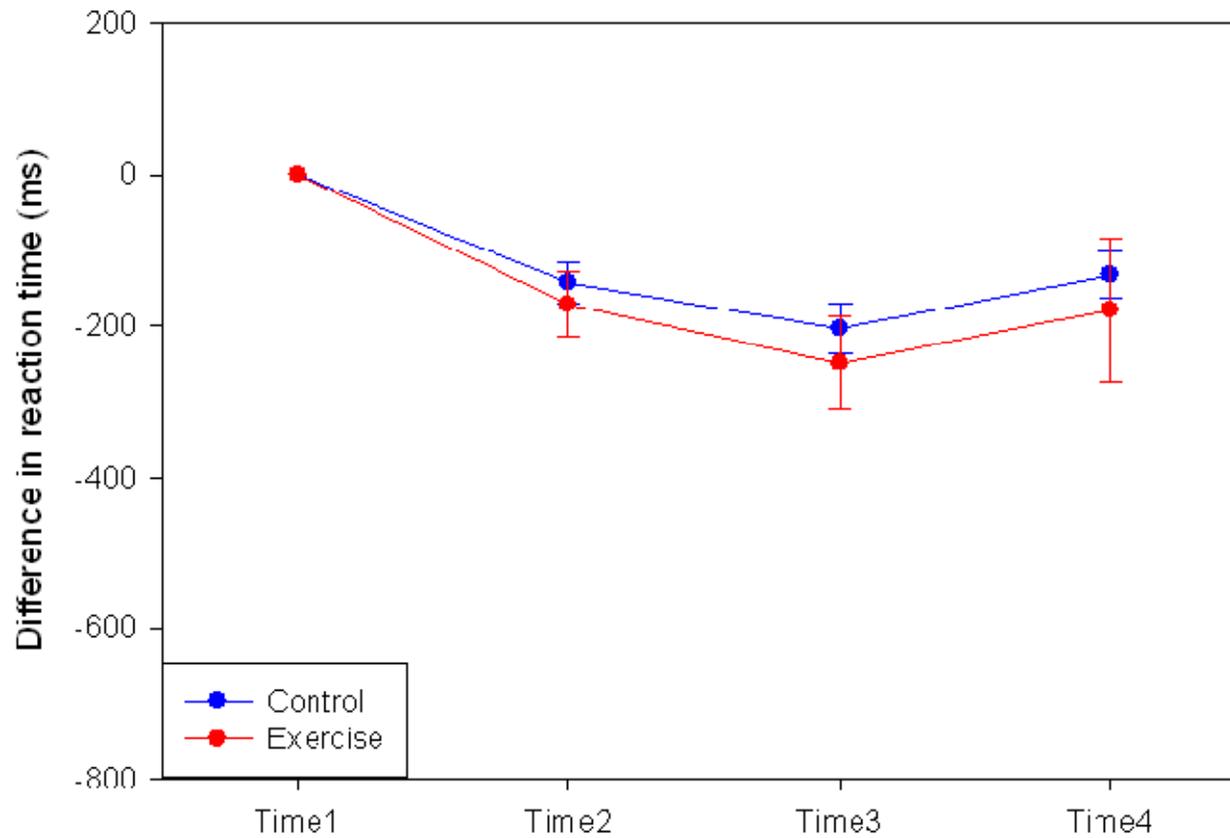
FLANKER: DIFFERENCE IN PERCENT CORRECT

Flanker: Difference in Incongruent Percent Correct



FLANKER: DIFFERENCE IN INCONGRUENT REACTION TIMES

Flanker: Difference in Correct Incongruent Reaction Times



APPALACHIAN ACADEMIC SUCCESS AND FITNESS DATA (WITTEBERG, COTTRELL, DAVISL, NORTHRUP)

- Participants were compared on WESTEST and FITNESSGRAM in a longitudinal study between their 5th and 7th grade years in school
 - WESTEST is a criterion-based reference for academic performance for students grades 3-8 and 10.
 - Aerobic fitness tested by either PACER or Mile Run test
 - PACER tests how many times the participant can do relays back and forth in a 20-meter space at an increasing pace.
 - The Mile Run test assesses how long it takes a participant to run/walk a mile.
 - FITNESSGRAM is used to assess:
 - Aerobic capacity
 - Upper body strength and endurance
 - Flexibility
 - Trunk strength and flex



AEROBIC FITNESS THRESHOLDS ASSOCIATED WITH FIFTH-GRADE ACADEMIC ACHIEVEMENT (WITTEBERG, COTTRELL, DAVIS, NORTHRUP, 2010)

- Association found between aerobic fitness and academic achievement in West Virginia 5th Graders
 - Gender and meal program controlled for
 - FITNESSGRAM uses different standards for boys and girls, so a breakdown between genders was used:
 - Significant correlations among boys on all WESTEST scores and Mile run.
 - Significant correlations found among girls on all WESTEST scores and PACER.
 - Girls also showed a significant correlation between Mile Run test and Reading WESTEST scores.



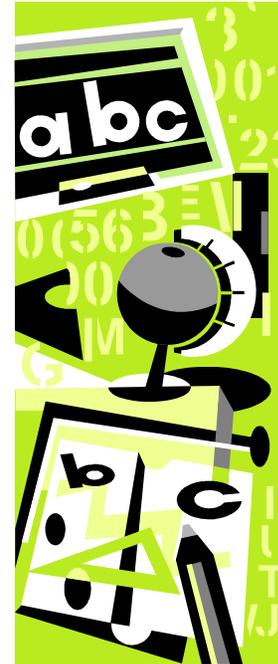
APPALACHIAN LONGITUDINAL DATA

- FITNESSGRAM Zones:
 - Healthy Fitness Zone (HFz)= meets or exceeds fitness target.
 - Needs Improvement Zone (NIz)= fails to meet fitness target.
- Results:
 - HFz 5th and 7th graders scored significantly higher on WESTEST than NIz 5th and 7th graders.
 - Students who moved into HFz or out of HFz had similar scores to those participants who stayed in the HFz over the two year span
 - These students scored significantly higher than those who never moved from the NIz.
 - These students demonstrated possible moderate fitness, but the FITNESSGRAM doesn't assess a "moderate" fitness zone.



EXERCISE ALSO IMPROVES OTHER AREAS IMPORTANT TO ACADEMIC SUCCESS!

- Peer acceptance
- Depression and Self-Worth
- Anger Control
- Sleep



PEER ACCEPTANCE

- According to the National Longitudinal Study of Adolescent Health (Strauss & Hill, 1998)
 - Children who are obese are least likely to be classified as a “friend” by peers
 - Obese children have fewer reciprocated friendships
 - The number of reciprocated friendships is directly proportional to the amount of overweight a child is.



NEGATIVE PEER PERCEPTIONS OF OBESE CHILDREN IN THE CLASSROOM ENVIRONMENT (ZELLER, REITER-PURTRILL, & RAMEY, 2008)

- Compared to non-overweight children:
 - Obese children were named significantly fewer times as someone's best friend
 - 32% of obese children had no reciprocated friends
 - Majority of obese children had at least 1 mutual friend.
 - Peers and self-reports indicated obese children were perceived as more sensitive and socially isolated
 - Peers reported obese children as less attractive, less athletic, more ill, and more fatigued.
 - Peers perceive obese children as more disruptive and aggressive
 - Teachers rated obese children as more pro-social than their non-overweight peers.
 - Obese self-reported as feeling victimized, while also perpetrating bullying among peers.



SO, OBESE AND OVERWEIGHT CHILDREN FEEL LEFT OUT...WHAT DOES THIS MEAN?

- Children who feel isolated, rejected by peers, etc. are at a high psychosocial risk.
- Obese children are more likely to miss school due to illness, as well as avoidance of psychosocial stress.
- Children who feel as these obese youth feel are more likely to become adults who
 - Have lower self-esteem
 - Greater risk of depression
 - Developmental delays in
 - Job competency
 - Marriage
 - Having children
 - Involvement in the community



DEPRESSION AND SELF-WORTH

- A benefit from exercise was shown in Petty et. al's (2009) study of overweight children in decreasing feeling of depression and Global Self-Worth
 - A dose-response benefit of exercise was apparent in the Reynolds Children's Depression Scale (RCDS) scores.
 - The 40-minute exercise group showed lower posttest scores on the RCDS than the control group.
 - BMI z-scores are correlated significantly with social acceptance scales and physical appearance
 - Global Self-Worth (Harter Self-Perception Scale) was significantly higher in the 40-min exercise group
- Interestingly, there is a culture difference in self-worth:
 - Black culture more accepting of obesity among women than Caucasian cultures.



ANGER CONTROL

- An aerobic exercise program showed evidence of anger expression reduction among overweight children. (Tkacz et. al. 2008)
- The Pediatric Anger Expression Scale (PAES) was used to measure anger expression in a dose-response study of exercise and overweight children.
- Scales that indicated improvement from the PAES in this study were Anger Out and Anger Expression.
 - Anger Out= anger openly expressed (e.g. I show my anger, lose my temper, slam doors, hit someone)
 - Anger Expression= (Anger In + Anger Out) – Anger Control



ANGER CONTINUED

- Fitness was a significant predictor of posttests Anger Out, indicating that an improvement in fitness predicts an improvement on the Anger Out scale.
- Anger is associated with increased prefrontal lobe activity (executive functioning site) (Harmon-Jones & Sigelman, 2001)
- Exercise decreases stress by altering serotonin and norepinephrine in the brain (Greenwood, Foley, Day, et. al., 2003)



SLEEP



- Sleep is affected by overweight and obesity!
 - Hypoxia from sleep apnea may cause irreversible damage to the developing brain (Kheirandish, Gozal, Pequignot, Pequignot, & Row, 2005)
- Overweight and obese children are at higher risk for sleep-disordered breathing (SDB) than non-overweight children.
(Daniels, et.al. (2005); Mallory, Fiser, & Jackson (1989); Silvestri, et. al. (1993))
- Children who are overweight and who have SDB are more likely to express symptoms of ADHD and other behavioral disorders (Chervin, Archbold, Dillon, et.al. (2002); O'Brien, Holbrook, Mervis, et.al. (2003))
- Davis et. al. (2006) indicated in a dose-response group, exercise improved sleep-disordered breathing in children
 - $\frac{1}{4}$ of the children in the study (25/100) screened positive for SDB
 - $\frac{1}{2}$ of the children who screened positive for SDB screened negative after the intervention.



HEALTHY AUGUSTA

- Mission:

- Our task force endeavors to improve the overall health of the CSRA with an emphasis on awareness and action against overweight and obesity.

- Vision:

- Multidisciplinary approach to focus on applying empirically-based knowledge for the good of our community through action and awareness.

- Method:

- Application of Dynamic Social Impact Theory

