



## PHYSICAL FITNESS, ACADEMIC ACHIEVEMENT AND STUDENT BEHAVIOR

*(Delaware Department of Education, Nemours Health & Prevention Services)*

### Introduction

A number of research studies suggest a link between physical activity and health outcomes<sup>i ii iii</sup> and between physical activity, and student behaviors, and academic achievement<sup>iv vi vii</sup>. Specifically, studies have shown that physical activity is linked to better concentration, reduced disruptive behaviors and higher test scores in reading, math and writing<sup>viii</sup>. A recent study has shown that exercise improves executive function (i.e., planning behaviors such as self-regulation and intentionality) and academic performance and increases brain activation<sup>ix</sup>.

### The Study

The Delaware Department of Education (DOE) and Nemours Health & Prevention Services (NHPS) collaborated to analyze the relationships among Delaware student physical fitness levels (as measured by FitnessGram<sup>®</sup>), academic outcomes (as measured by Delaware Student Testing Program (DSTP) scores) and student behaviors (attendance and suspension rates as tracked by eSchoolPLUS). FitnessGram<sup>®</sup> is a health related fitness assessment tool developed by the Cooper Institute<sup>x</sup>. The tool uses criterion-referenced standards, called Healthy Fitness Zones (HFZ), to define healthy levels of physical fitness. Delaware DOE requires annual testing of students (grades 4, 7, 9/10) on five FitnessGram<sup>®</sup> tests measuring aerobic capacity, strength, endurance and flexibility. The ideal outcome is for students to be in the HFZ for all five tests.

FitnessGram<sup>®</sup> and eSchoolPLUS data for two school years (SY 2008–09 and SY 2009–10) were merged and de-identified, and a series of data quality control steps were completed, including excluding cases without all five mandated tests. The final number of usable cases was 80,064.

### Results: Statewide Sample

#### ***Relationship between fitness level and academic achievement***

The analysis of statewide data shows a significant ( $p \leq 0.05$ ) linear relationship between academic achievement scores and students' fitness levels after controlling for gender, race, family income level and school district. Reading and math DSTP performance levels were selected as the indicators for academic achievement. Although there are five DSTP performance levels, the two extreme DSTP performance levels "Distinguished" and "Well below the standard" were selected for clarity of display (see Figures 1, 2, 3 and 4 for 4<sup>th</sup> graders' performance in the reading and math tests). Figures 1 and 3 show that as fitness levels increase, the percentage of students at the "Distinguished" performance level for math and reading increases; while figures 2 and 4 show that the percentage of students at the "Well below the standard" DSTP math and reading level decreases as fitness level increases.

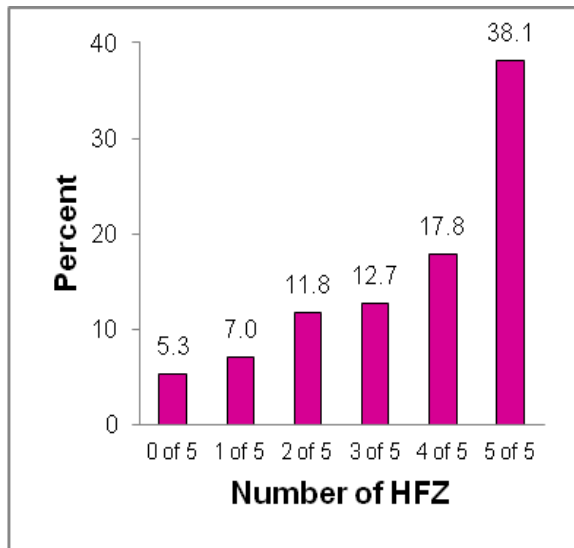


Figure 1: Percentage of 4<sup>th</sup> graders achieving “Distinguished” performance on DSTP reading test by fitness levels, SY 2008–09 and 2009–10 combined

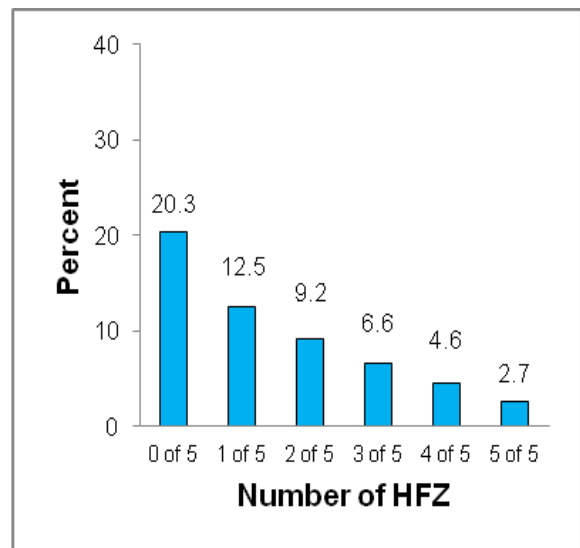


Figure 2: Percentage of 4<sup>th</sup> graders achieving “Well below the standard” performance on DSTP reading test by fitness levels, SY 2008–09 and 2009–10 combined

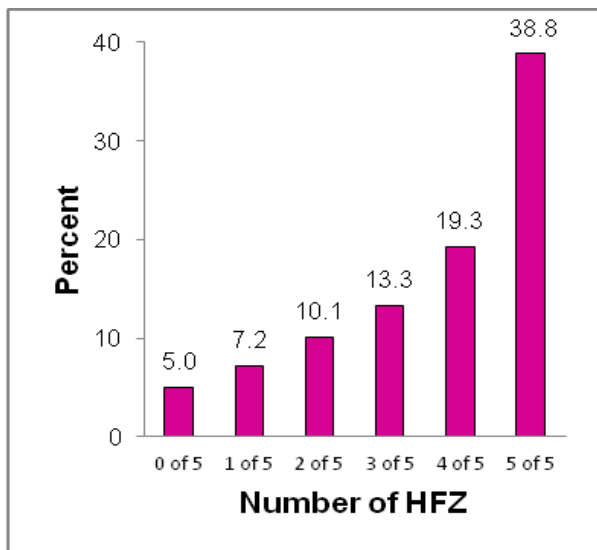


Figure 3: Percentage of 4<sup>th</sup> graders achieving “Distinguished” performance on DSTP math test by fitness levels, SY 2008–09 and 2009–10 combined

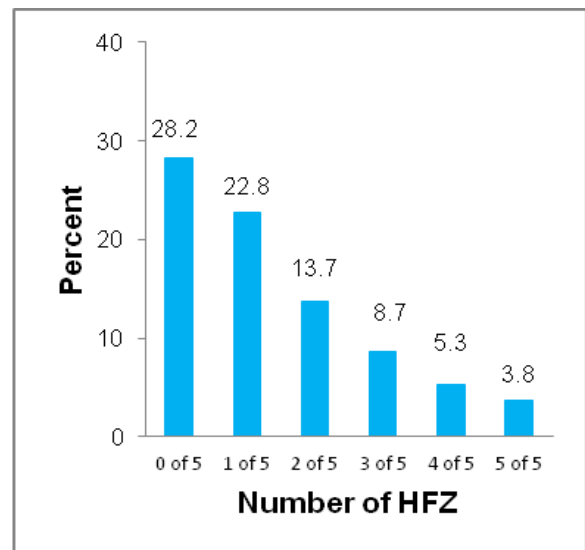


Figure 4: Percentage of 4<sup>th</sup> graders achieving “Well below the standard” performance on DSTP math test by fitness levels, SY 2008–09 and 2009–10 combined

### ***Relationship between fitness levels and days of suspension***

The statewide data show significant differences ( $p \leq 0.05$ ) in the mean number of suspension days by different fitness levels, after controlling for gender, race, family income level and school district (see Figure 5).

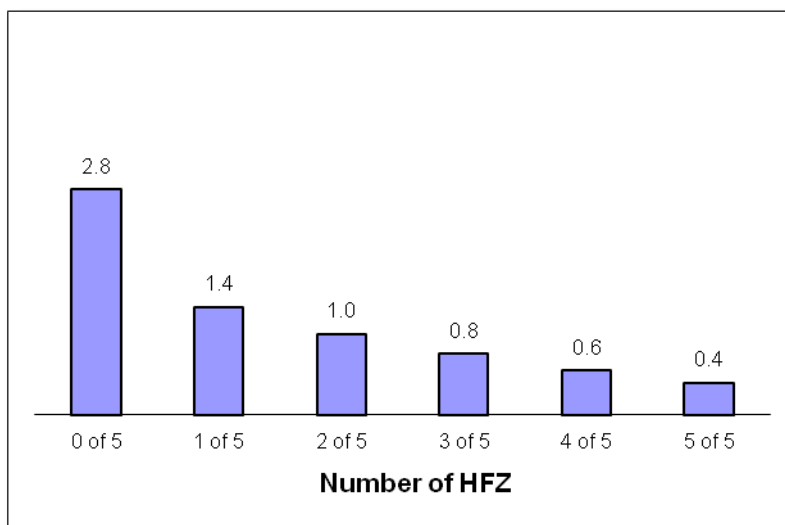


Figure 5: Mean suspension days for DE public school students by fitness levels, SY 2008–09 and SY 2009–10 combined (n=78,206)

### ***Relationship between fitness levels and student attendance***

Results from the statewide data set show significant differences ( $p \leq 0.05$ ) in the mean number of attendance days by fitness levels after controlling for gender, race, family income level and school district (see Figure 6).

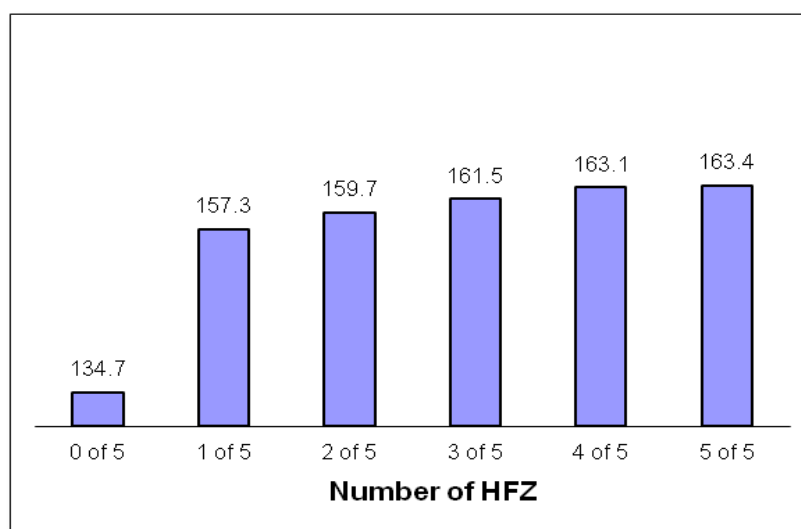


Figure 6: Mean attendance days for DE public school students by fitness levels, SY 2008–09 and SY 2009–10 combined (n=78,244)

## Conclusion

It is important to note that the analyses of statewide data showing the relationship between fitness and academic performance, attendance days and days suspended were calculated by using cross-sectional data; and therefore, the results do not imply causality. However, the data show a clear and consistent relationship between fitness and academic achievement and fitness and student behaviors. Although it is not possible to infer causal relationships between the variables from this cross-sectional data set, it is our recommendation that stakeholders use these findings to support Delaware schools in continued efforts to promote quality physical education and physical activity to enable all students to achieve all five HFZ.

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<sup>i</sup> Paffenbarger, R.S., Hyde, R.T., Wing, A.L. and Hsieh, C. (1986). Physical activity, all-cause mortality, and longevity of college alumni. *New England Journal of Medicine*, 314, 605± 613.

<sup>ii</sup> Gordon-Larsen P, McMurray RG, Popkin BM. 2000. Determinants of adolescent physical activity and inactivity patterns. *Pediatrics* 105:1-8.

<sup>iii</sup> Sallis, J. F., Prochaska, J. J., & Taylor, W. C. (2000). A review of correlates of physical activity of children and adolescents. *Medicine & Science in Sports & Exercise*, 32, 963-975.

<sup>iv</sup> Sallis, J.F., Conway, T.L., Prochaska, J.J., McKenzie, T.L., Marshall, S.P., & Brown, M. (2001). The association of school environments with youth physical activity. *American Journal of Public Health*, 91, 618-620.

<sup>v</sup> Taras, H. (2005) Physical Activity and Student Performance at School. *Journal of School Health*. (75)(6) 214-218.

<sup>vi</sup> Scheuer, L. & Mitchell, D. (2003). Does physical activity influence academic performance? The New PE and Sports Dimension Retrieved March 31, 2011 from <http://www.sports-media.org/sportapolisnewsletter19.htm>

<sup>vii</sup> Tremblay, M. S., Inman, J. W., & Willms, J. D. (2000). The Relationship Between Physical Activity, Self-Esteem, and Academic Achievement in 12-Year-Old Children. *Pediatric Exercise Science*, 12, 312-324.

<sup>viii</sup> Satcher, D. (2005). Healthy and Ready to Learn: Research shows that nutrition and physical activity affect student academic achievement. *Educational Leadership* (63) 26-3

<sup>ix</sup> Davis, C.I., Tomporowski, P.D., McDowell, J.E., Austin, B.P., Miller, P.H., Yanasak, N.E., Allison, J.D., and Naglieri, J.A. (2011). Exercise improves executive function and achievement and alters brain activation in overweight children: A randomized, controlled trial. *Health Psychology* 2011, v30 (1), 91-98

<sup>x</sup> The Cooper Institute. *FitnessGram Overview*. Retrieved March 31, 2011 from <http://www.fitnessgram.net/programoverview/>