



# EFFECTS OF THE PHYSICAL ENVIRONMENT ON STUDENT LEARNING

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# PHYSICAL ENVIRONMENT & STUDENT ACHIEVEMENT

- Research on how school buildings influence student/teacher performance.
- A Decade and a Half of Work.
- So Many of School Buildings in Unsatisfactory Condition in US.
- Particularly Interested in Adverse Conditions and Student Achievement.
- In the Hopes School Authorities Would Act.

# GREEN SCHOOL MEASURES

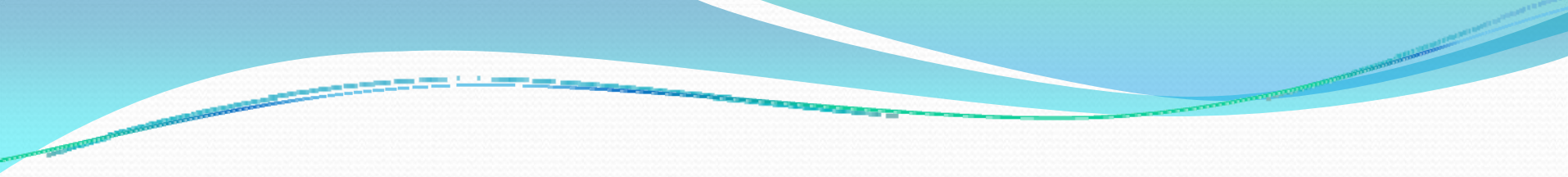
- Instrument Completed before Emphasis upon Green Schools or Sustainability.
- Included Green School Measures of AC, Lighting, Daylighting, Acoustics, Site.
- Other Measures – Condition of ceilings, furniture, lockers, science equipment.
- Wall colors, graffiti evidence, Auxiliary Buildings.

# ASSESSMENT OF BUILDINGS

- Commonwealth Appraisal of Physical Environments (CAPE).
- Completed by Principals & Verified by Researcher for Accuracy.
- Were able to Determine Standard and Sub-Standard School Buildings Based upon CAPE.
- Compared Achievement of Students in Both Types of Buildings.

# FINDINGS

- Students in Sub-standard Buildings Scored Below Students in Standard Buildings consistently.
- Differences ranged from 2% to 17% Depending upon the Sub-test.
- All Studies Found Significant Differences in Mathematics.
- Most Studies Found Significant differences in English, Science, & Social Studies

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- Lanham (2000) – Elementary Students Grades 3 & 5.
  - Different Statistical Methodology-Regression analysis.
  - SES was Major Contributor to Student Learning.
  - Found AC was the Next Contributing Factor in Student Learning.

# FINDINGS

- This Means that Students in Sub-standard Buildings are Falling Behind Students in Standard Buildings.
- Do Students Fall Behind Year by Year?
- No Longitudinal Studies of Influence of Building on Student Achievement.
- Area of needed Research.



# AC LONGEVITY & STUDENT ACHIEVEMENT

# ACHIEVEMENT

- Control of the Thermal Environment is VERY important to student learning and teacher productivity.
- Previous studies measured bodily functions -  
Blood Pressure, Cavities, Breathing, etc.
- Few studies used academic measures directly.
- No study has Looked at Longevity of AC

# ACHIEVEMENT

- How does AC Affect Student Performance and is there an Influence over a Period of Years?
- Two purposes of the study:
  1. How much influence does AC have upon student learning?
  2. Is there a long term effect of AC on student achievement?

# AC LONGEVITY & STUDENT ACHIEVEMENT

- Surveyed principals – Find out if AC in the classrooms. Mailed survey to high schools.
- Principals asked if AC was in the classrooms.
- School Visitation.
- Result of Survey – 10 schools – 5 with AC and 5 without AC in Classrooms.
- Population of the study 10 small schools.

# AC LONGEVITY & STUDENT ACHIEVEMENT

- Each school was small – R = 500-900 students.
- Each school located in a small community.
- Schools not subject to much immigration or emigration – Key to the population.
- Population was for most purposes same over six years of schooling.
- Schools were demographically similar- drop-outs, teacher preparation, minority, SES, pupil-teacher ratio.

# AC LONGEVITY & STUDENT ACHIEVEMENT

- Mean scaled scores on Stanford Achievement Test used as Measures of Achievement.
- Ten sub-tests – Among them: English, Math, Science, Social Studies.
- Obtained scores for 4<sup>th</sup>, 6<sup>th</sup>, and 9<sup>th</sup> grades.
- Same students over 6 years of learning.

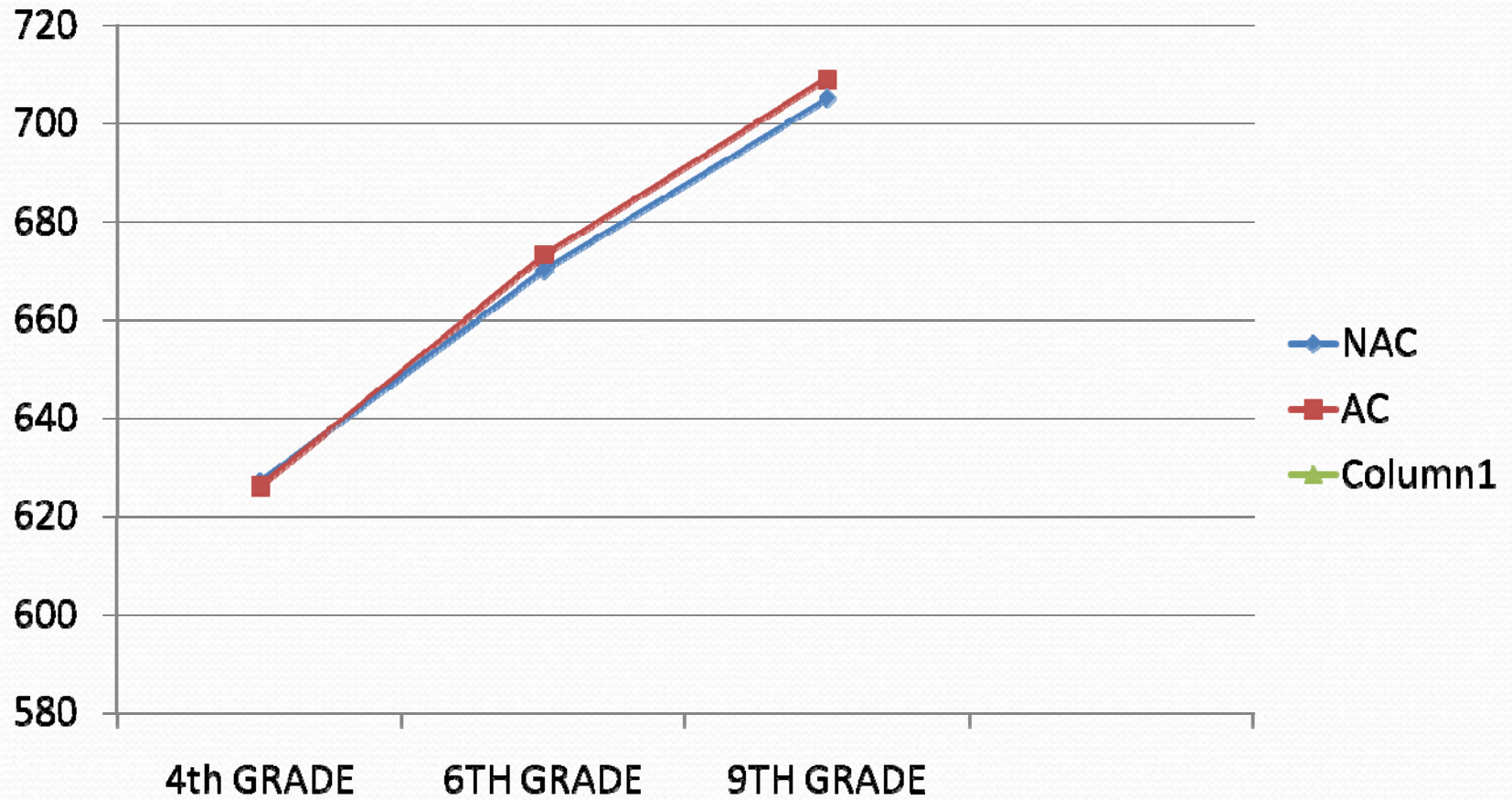
# FINDINGS

- Time 1 was comparison between the scores of students in AC and Non-AC schools for each grade.
- Mean scores were higher in AC schools in all subtests, but not statistically significant.
- Some Mean scores in 4<sup>th</sup> grade not higher in AC schools.

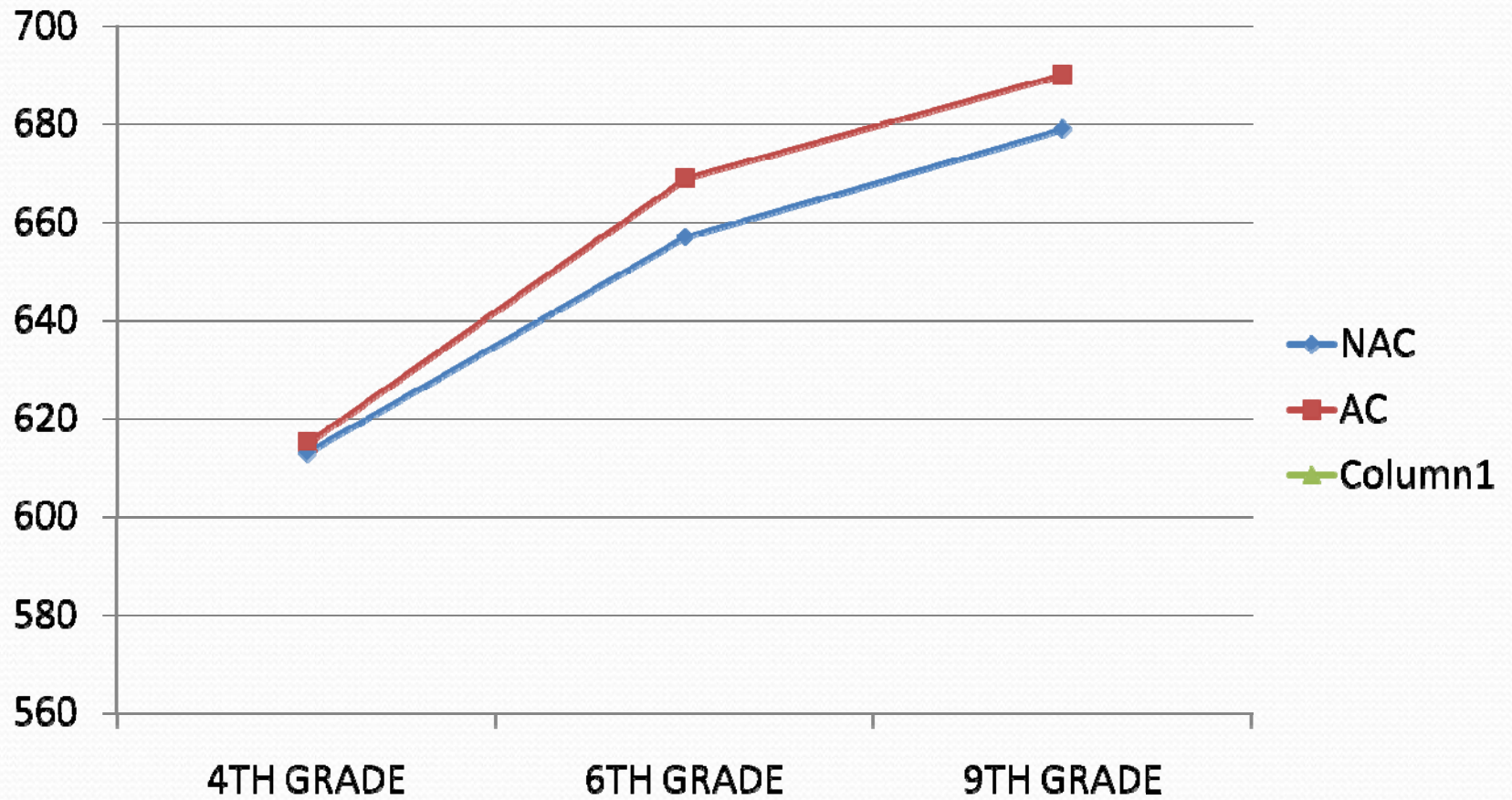
# AC LONGEVITY & STUDENT ACHIEVEMENT

- Time 2 – comparison of scores between:
  - 4<sup>th</sup> Grade & 6<sup>th</sup> Grade
  - 6<sup>th</sup> Grade & 9<sup>th</sup> Grade
  - 4<sup>th</sup> Grade & 9<sup>th</sup> GradePlotted on Graph for better viewing.  
Provides a better comparison over several years.

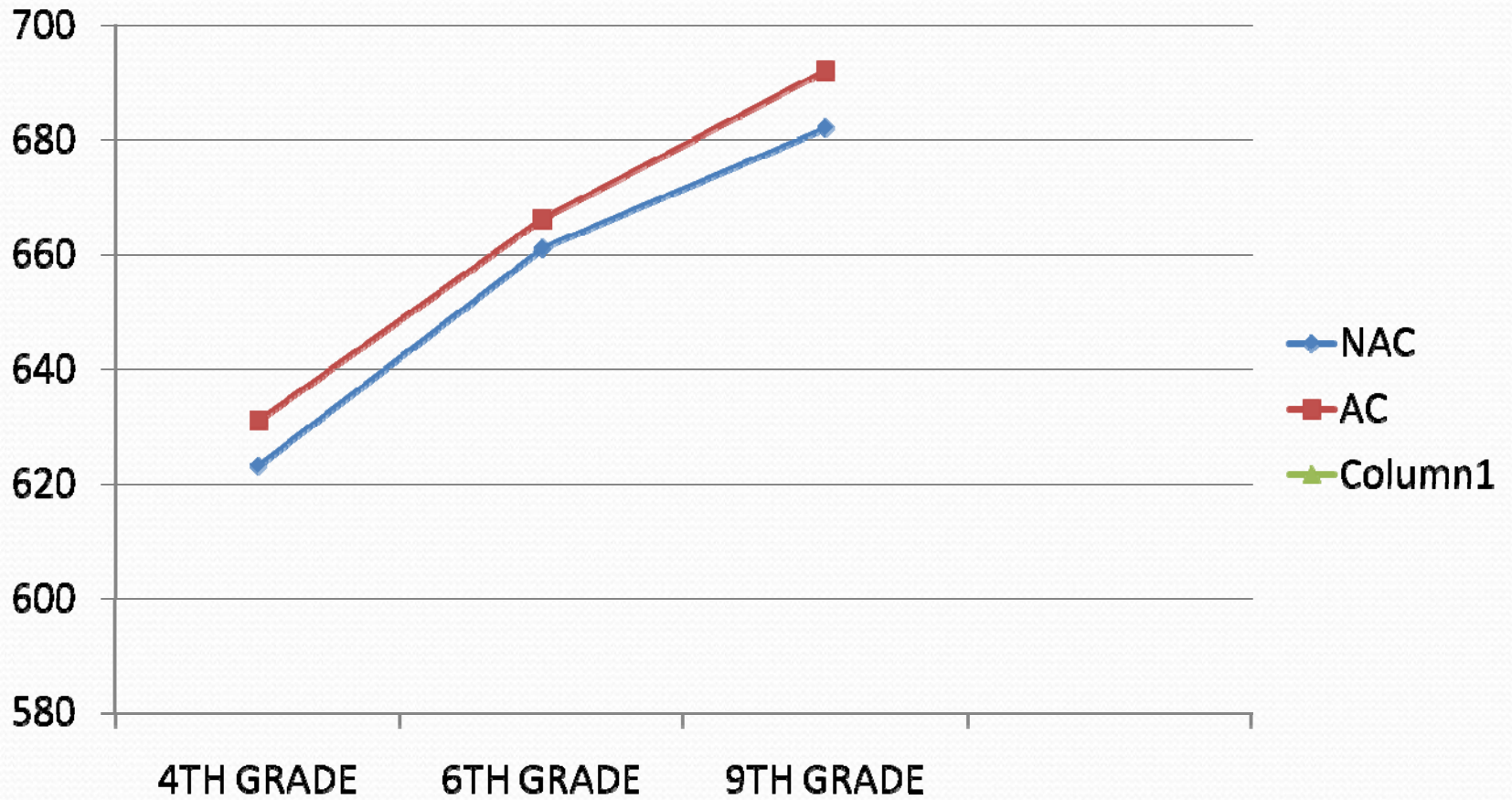
# Reading Vocabulary



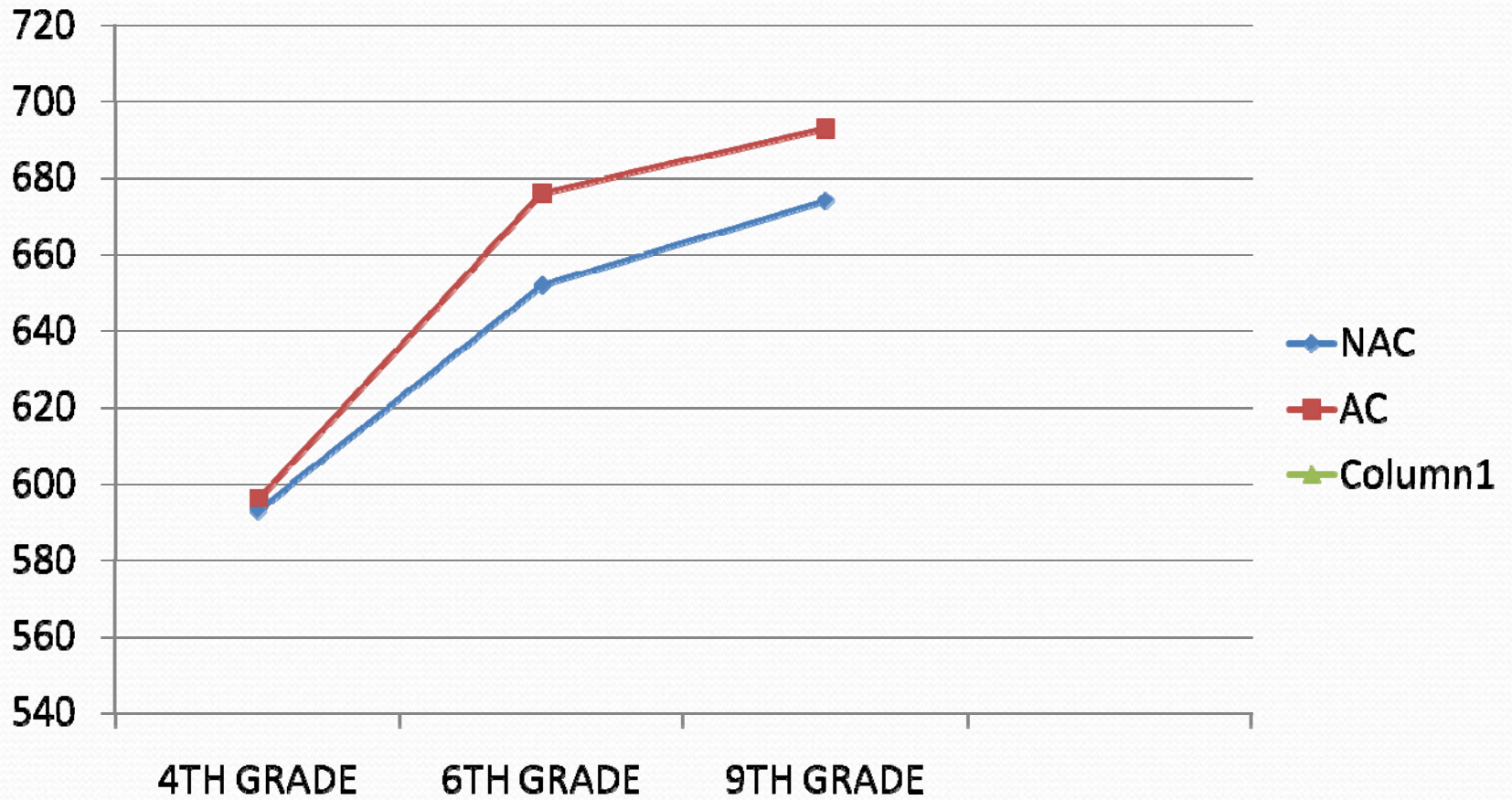
# TOTAL MATH



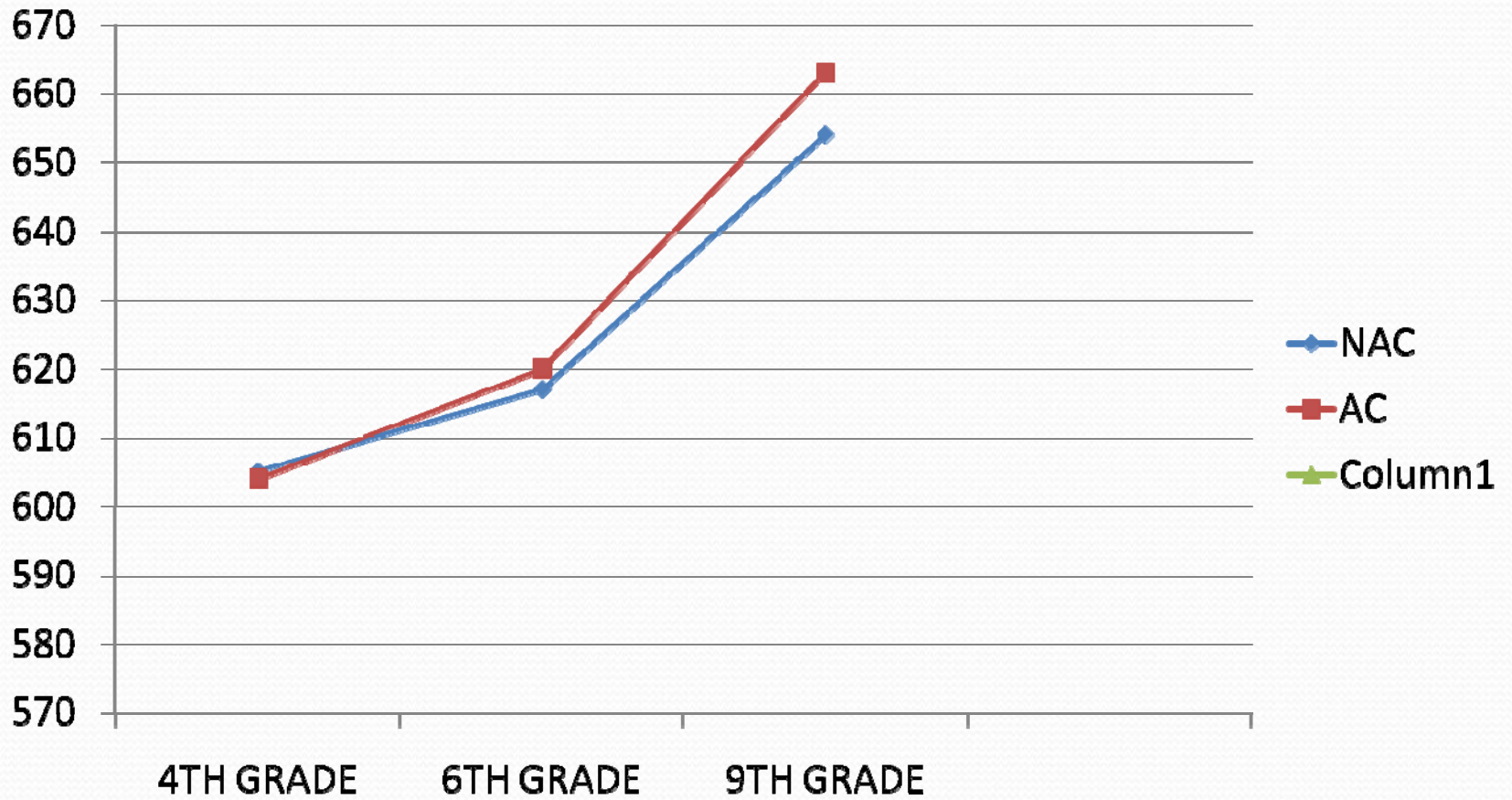
# PROBLEM SOLVING



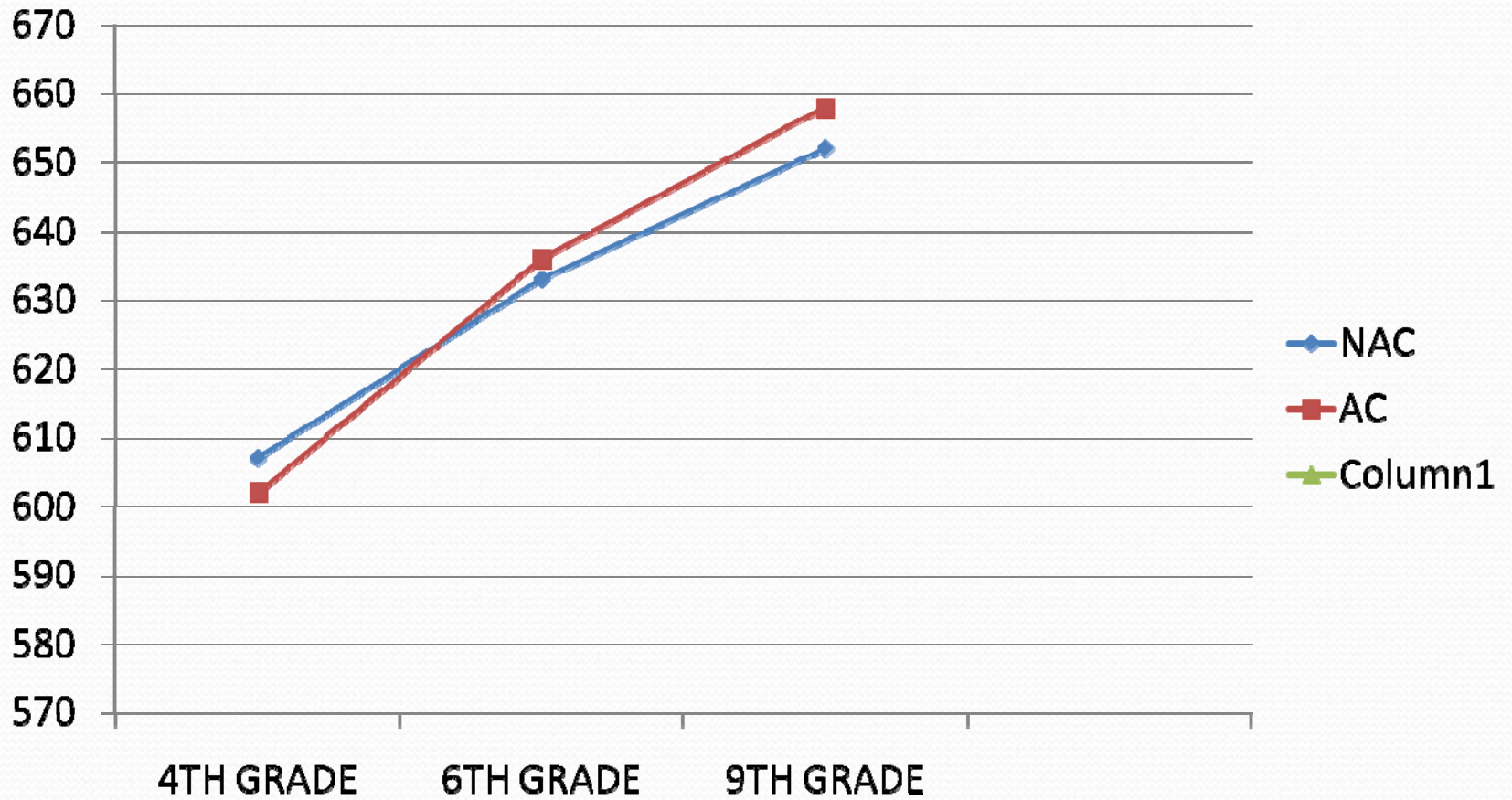
# MATH PROCEDURES



# PRE-WRITING



# EDITING



# AC LONGEVITY & STUDENT ACHIEVEMENT

- Statistical Analysis resulted in a Significant Difference in Scores in Sub-tests of Total Mathematics and Mathematics Procedures.
- Indicating AC did make a Significant Difference between the Two Scores.
- There were Important Trends Indicating a Difference in Scores between AC and NAC School Buildings.

# LIMITATIONS

- Not able to Measure Quality of AC in Classrooms. No IAQ Test Made. Funding Problem.
- Was not able to Measure Degree Temperature Days in All School Divisions.
- Small Schools have Particular Characteristics that help Students.

# AC LONGEVITY & STUDENT ACHIEVEMENT

- What can be Concluded?
  - AC does have a Positive Affect upon Students?
  - The Longer a Student is Exposed to AC the Better the Student Performance.
  - Conversely, Longer Students do not have AC the Less They will Score on Achievement Tests.
  - This Study Supported Previous Research.