

Using Common Core State Standards of Seventh Grade Mathematics in the Application of NXT LEGO® Robotics for CReSIS Middle School Students



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Overview

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Abstract

In 2010 Common Core Standards included critical content for all students in American education for forty-five states. Previously, every state had its own set of academic standards and students in each state were learning at different levels. In the new global economy, all students must be prepared to compete on a global basis. Students are expected to develop a deeper mastery of content and demonstrate what they know through writing and other projects. The North Carolina Department of Instruction's current curriculum and instruction are more student-centered with greater focus on skills, abilities, and a shift towards more performance assessments. This research was designed to focus on mathematical processes of the Common Core Standard in mathematics lesson plans for seventh grade students. A group of seventh grade students from two middle schools of Elizabeth City Public Schools in northeastern North Carolina were selected for this research at Elizabeth City State University (ECSU) for the Center of Remote Sensing of Ice Sheets (CReSIS). Pre and post test data were collected through student assessments and teaching observations to evaluate student growth in content knowledge, understanding and application. The REU Mathematics Teacher Team used mathematics strategies to teach various scientific, mathematical, and design concepts, through designing, by programming NXT LEGO® Robotics for the seventh grade level. The students received hands on experience for robotics construction and programming with application of mathematics, motion, and problem solving in a collaborative group setting.



Methodology

- Constructed a lesson plan using the 5 E learning cycle model
- Pre-test of Common Core 7th grade standards from NCDPI test bank
- Assigned Math Fun worksheet, reviewed and taught content on test items'
- Post Test
- Introduced NXT Lego robotics to the students (components, the design, and testing)
- Divided the students into three teams, one member will be monitoring one team of students
- Use the application of Common Core Standards and mathematics skills to assembly and program the robots
- The final project involved the students to program the robots to run an obstacle course designed by the RET team



Pre and Post Test

- We developed a pre test to assess how much the students know and the questions were based off the 5 strands of the 7th grade Common Core mathematics standards
- The post test was the same as the pre-test

The 5 Strands

- Ratios and Proportional Relationships
- The Number System
- Expressions and Equations
- Geometry
- Statistics and Probability



Application of NXT Lego[®] Robotics

Construction and Programming

- The students were responsible to construct their robot out of the Lego pieces



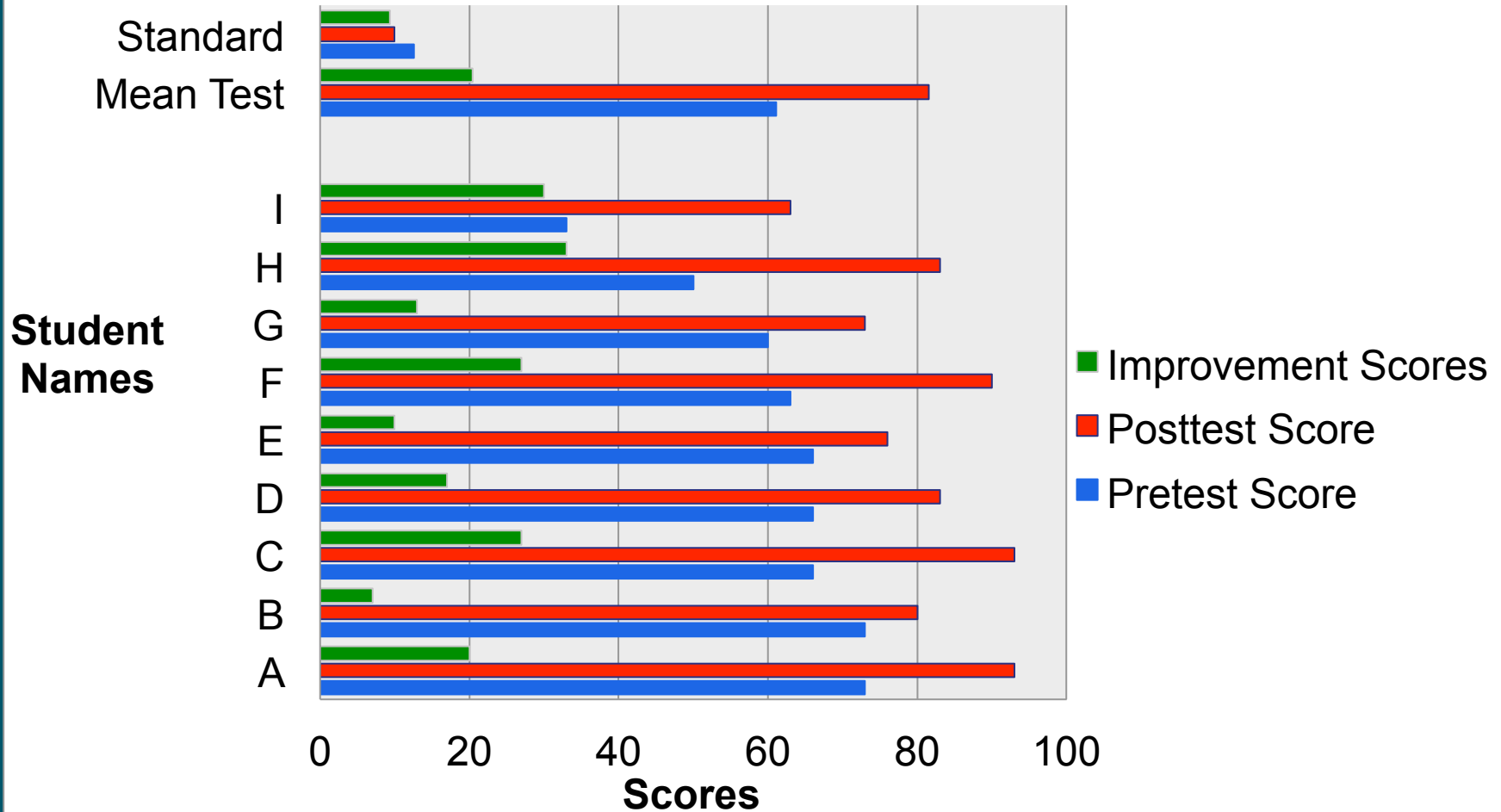
Results

- Itemized each question and calculated the percentage of students with incorrect answers
- Compiled scores from the pre and post test in order to analyze the improvement percentage of each student
- Developed graphs to display the pre and post test scores as well as the improvement scores and percentages of the students



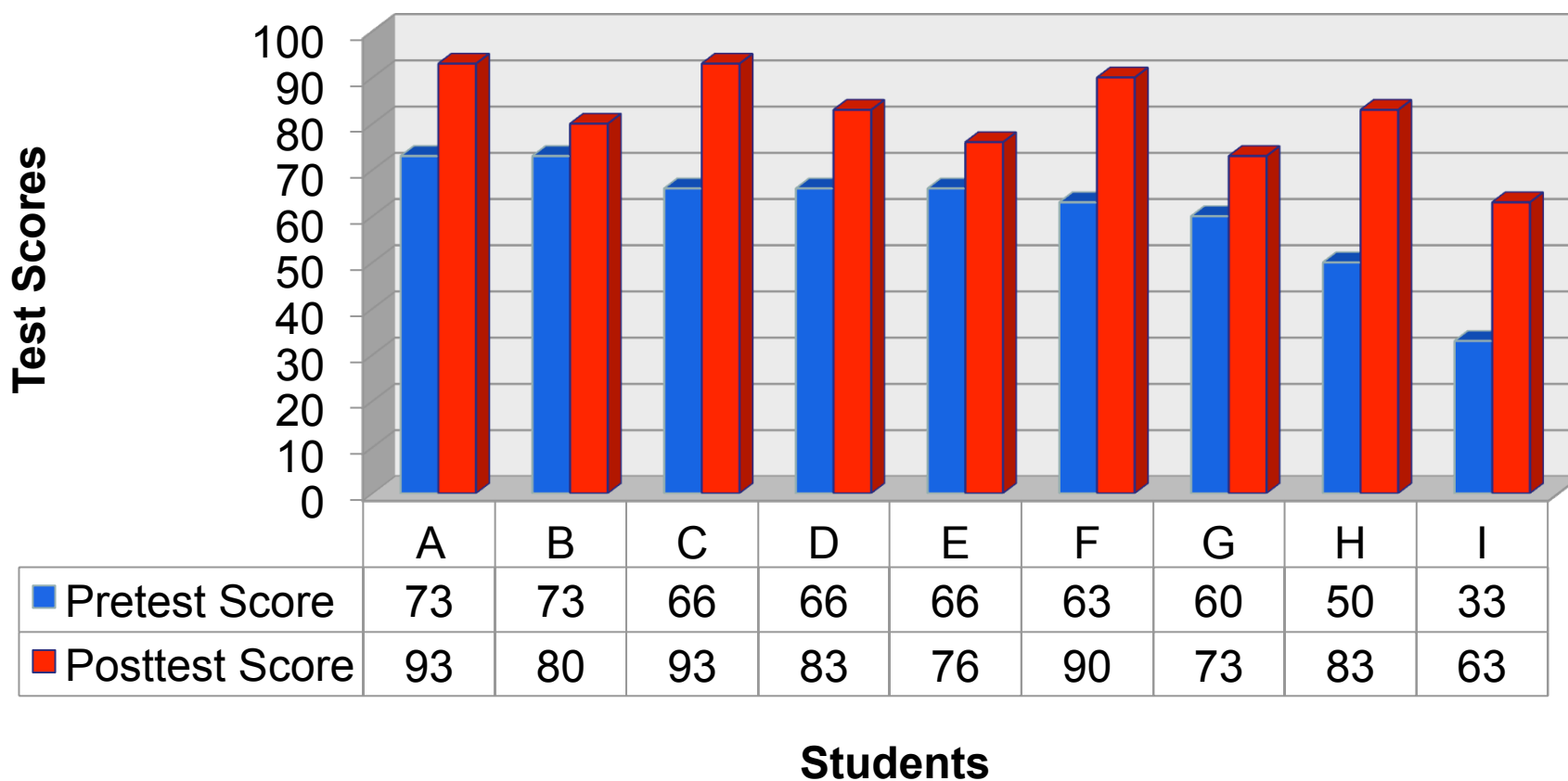
Results Cont.

2013 CReSIS Middle School Test Scores



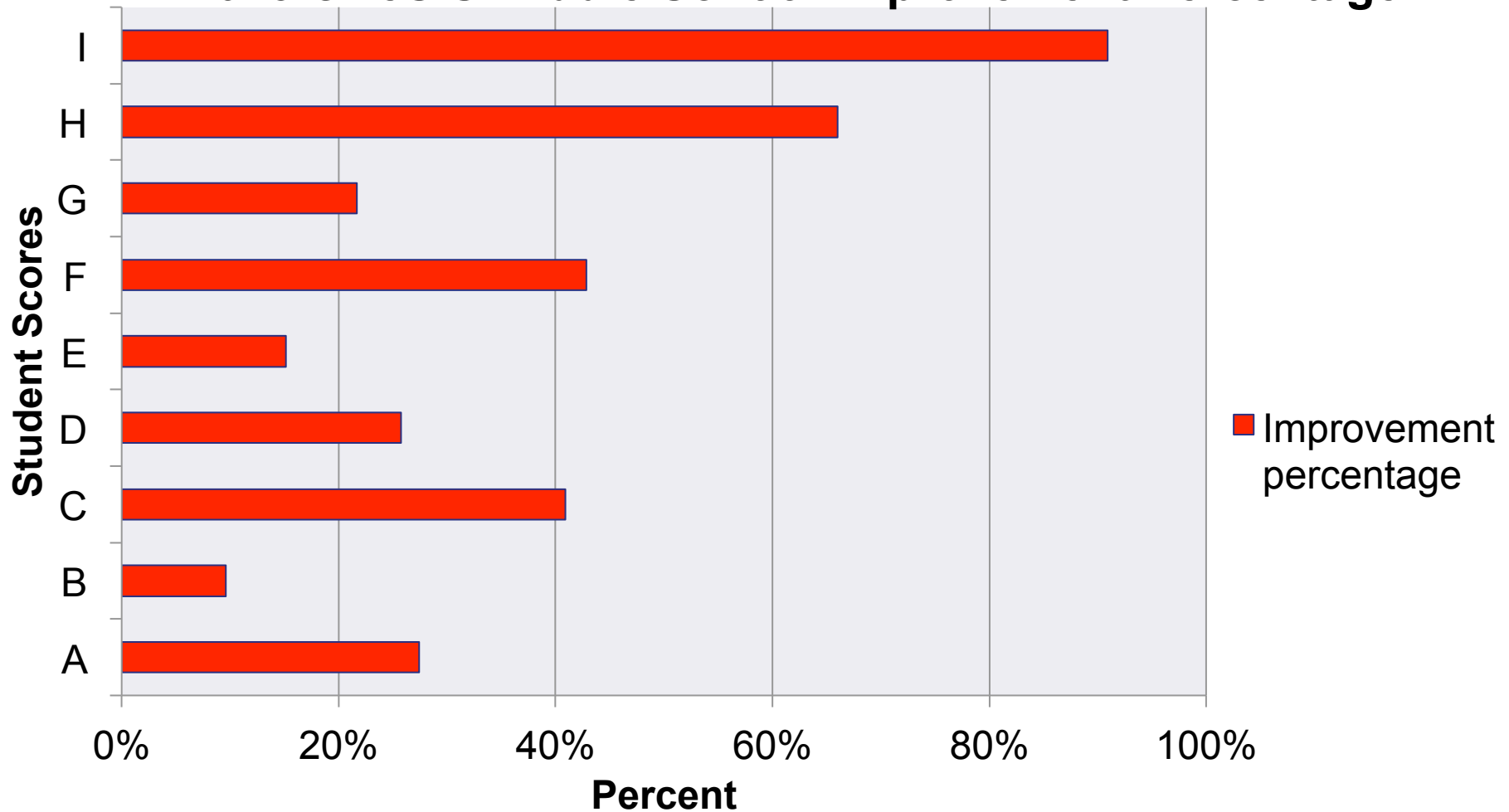
Results Cont.

2013 CReSIS Middle School Pre & Post Test Comparison



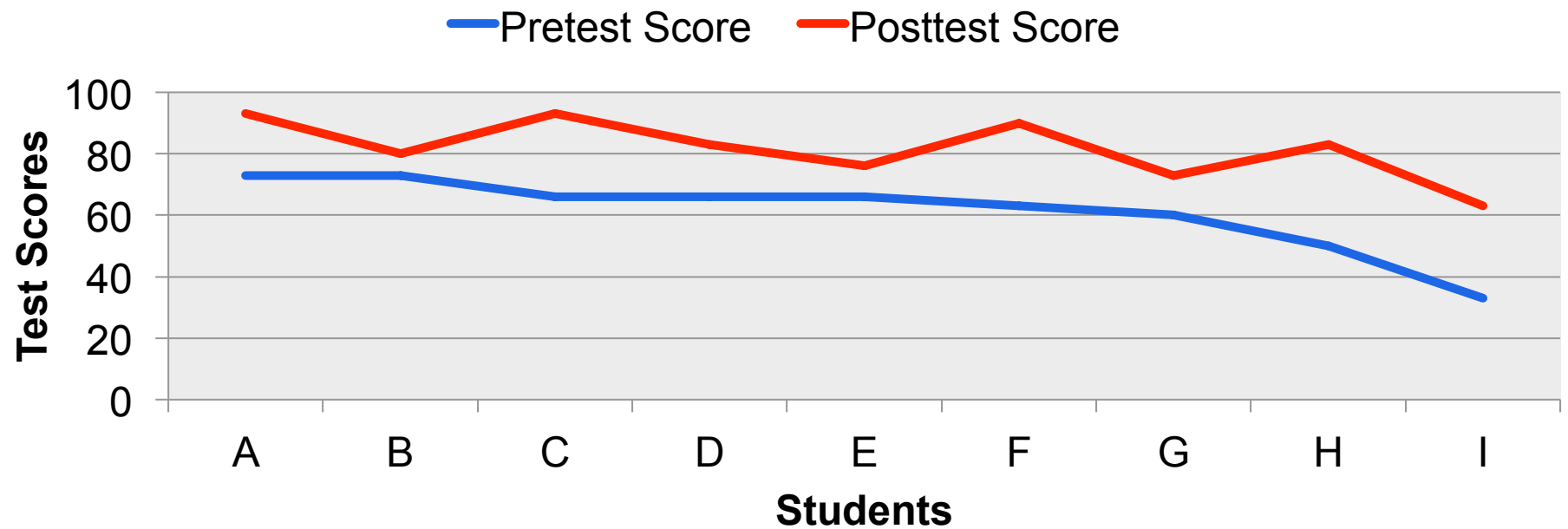
Results Cont.

2013 CReSIS Middle School Improvement Percentage



Results Cont.

2013 CReSIS Middle School Pre and Post Test Comparison



Conclusion

- The focus of this research project was to use the principles of the North Carolina Department of Public Instruction's Common Core Standard for 7th grade mathematics in a 5E lesson plan format and inquiry-based learning in application to Robotics. Effective use of a pretest to measure student content level, teaching needed mathematics skills in selected subjects, and posttest results from the End of Year seventh grade mathematics sample test showed growth in the achievement of Elizabeth City Middle School and River Road Middle School seventh graders.
- Twelve highly qualified seventh grade students were selected for this program with nine completing the program. The RET team divided students into three research groups to assemble and program NXT LEGO robots to compete on an obstacle course using basic applications of seventh grade mathematics. Along with classroom observation, data was collected from the students' scores on the pre and posttest. The numerical range was between thirty-three and seventy-three on the pretest. However, results on the posttest had scores of sixty-three to ninety-three. The mean score of the students improved by twenty points per student with a mean improvement percentage of thirty-eight percent per student. This research resulted in significant improvement in understanding of seventh grade mathematics content.



Future Work

- Monitor students' progress through middle and high school STEM related subjects.
- Encourage participation in future CReSIS summer programs.
- Survey student choice of career interests in STEM related majors and their college of choice.



Acknowledgements

The 2012 REU Mathematics Team would like to thank

- CERSER Principal Investigator, Dr. Linda B. Hayden
- Dr. Darnell Johnson
- Dr. Constance Bland



Questions?

QUESTIONS?

