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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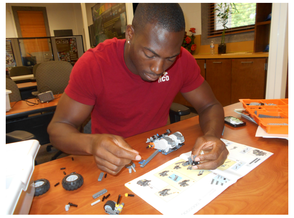
Abstract

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). Pretest and posttest data were collected through student assessments and teaching observations to evaluate student growth in content knowledge, understanding and application. The Research Experience Teachers (RET) 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

Key Terms— Common Core Mathematics Standards, NXT LEGO® Robotics, CReSIS



Methodology

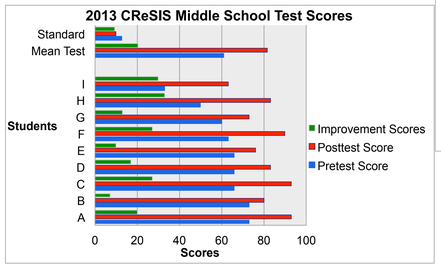
Before working with the students, the RET team studied the Common Core Standard for North Carolina, NXT LEGO® Robotics, and the 5E lesson plan. The process started by studying the five strands for 7th grade mathematics. Using those five strands the RET team constructed a lesson plan using the 5E learning cycle. They then created a pretest of Common Core Standards-7th grade, from North Carolina Department of Public Instruction bank. After the students took the test, the team-taught content using the test items that the majority of student answered incorrectly and assigned Math Fun worksheets for homework. A posttest was administered the students after the lessons were completed in order to calculate the students' improvement after being taught. Later the RET team introduced NXT Lego robotics to the students. The students were divided into three competitive teams to be monitored by a member of the RET team for each team of students. The students assembled and programmed the robots using the application of the Common Core Standards and mathematics skills they had learned. The final phase of the research project was the students programming robots to complete an obstacle course designed by the RET team.

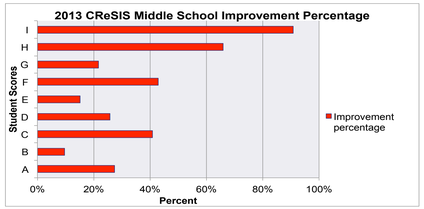
Analysis

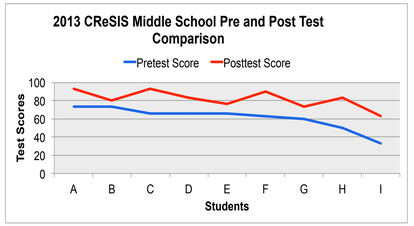
The North Carolina Science Essential Standards maintain the respect for local control of each Local Education Authority (LEA) to design the specific curricular and instructional strategies that best deliver the content to their students. The pre test and posttest questions were extracted from the North Carolina Department of Public Instruction (NCDPI) test bank. Engaging students in inquiry-based instruction is a critical way of developing conceptual understanding of the science content that is vital for success in the twenty-first century. [3] Here is a list of competencies the team used.

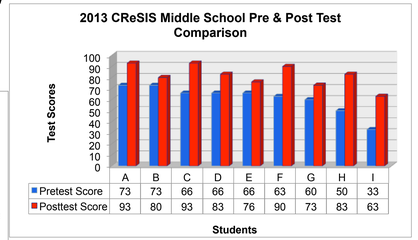
- Applying geometric formulas, in order to find the area of a shape or object.
- Comprehending angles and learning how to adjust the degrees of an angle.
- Develop understanding of fractions as numbers
- Solve problems involving measurement time and mass.
- Write and solve a number problem based on a real-world situation

The RET team was the facilitators over the groups. The team help mend problems in the build after the students finished building, along with facilitating in the testing and debugging phase. A problem that I noticed with all of the groups was the understanding of the instruction. However, the middle school students were very active in the construction of the NXT LEGO® robots. The facilitators spontaneously started a modern day "assembly line". The facilitators assigned each group member a page to assemble. The alternative enhanced the cooperativeness and dependency on one another. Each group member had to pay attention to the "assembly line" in order to know what portions needed to be done when it is their turn to assemble.









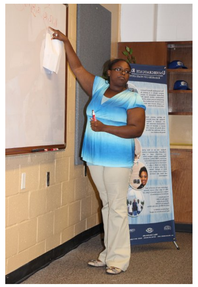
Conclusion

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

The purpose of this research was to use the North Carolina Common Core mathematical standards for the application of NXT Lego robotics. CReSIS will continue to monitor the progress of the past CReSIS middle school students through middle and high school STEM related subjects. The CReSIS staff will continue to search for highly qualified students to participate in future CReSIS summer programs at Elizabeth City State University. Once they have completed the program, the students will be ask to fill out a survey of career interests in STEM related majors and their college choice, as well as, help the CReSIS staff become aware of what can be improved about the program.



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