Using Engineering Activities to Support Communication and Collaboration Skills in a Special Needs Classroom

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Overview
The purpose of this paper is to provide a description of a program developed by way of an ongoing collaboration between a fifth grade special needs teacher in a culturally diverse urban area and a staff member from the K-12 outreach division of an engineering college that provides graduate courses, professional development, and in-class mentoring teachers in school districts throughout the state. The goal of the program described in this paper is to determine to what extent utilization of age-appropriate engineering activities can improve the 21st century skills of communication and collaboration that special needs students often have difficulty mastering. (see Table 1).

Partner School
The partner school is located in the state’s second largest city. The school district has total of 28,218 students; 3,396 are classified as special education students; 3,396 are classified as special education students; 3,396 are classified as special education students. It is hoped that the results of this study will support this statement and will demonstrate the need and value of engineering education as a way to facilitate student achievement of 21st century skills in classroom settings.

Approach/Methods/Materials
The CIESE staff member visited the class twice per month and led the lessons with the assistance of the teacher. The approach to instruction was to present introductory engineering activities before they are presented with a series of design challenges where the students use the engineering design process. All activities provided practice in written and oral communication and were completed in pairs or teams. Photographs of the students participating in these activities were posted on the PISA2 website and updated regularly. Written communication skills were assessed by portfolios containing samples of student work produced in conjunction with the engineering lessons that were maintained throughout the school year. Written communication skills were assessed by portfolios containing samples of student work produced in conjunction with the engineering lessons that were maintained throughout the school year. Written communication skills were assessed by portfolios containing samples of student work produced in conjunction with the engineering lessons that were maintained throughout the school year. Written communication skills were assessed by portfolios containing samples of student work produced in conjunction with the engineering lessons that were maintained throughout the school year. Written communication skills were assessed by portfolios containing samples of student work produced in conjunction with the engineering lessons that were maintained throughout the school year. Written communication skills were assessed by portfolios containing samples of student work produced in conjunction with the engineering lessons that were maintained throughout the school year.

Assessment
Rubrics, anecdotal records, and/or checklists were used to evaluate students’ oral communication and collaboration (group participation) skills. The purpose was to determine how well students communicated and to monitor their level of participation and cooperation during group activities. Rubrics and checklists were teacher created and based on the educational and behavioral needs of the students.

The students were evaluated on their mastery of the following skills:

- Positive interactive communication with other students during activities, planning sessions, etc.
- Peer collaboration and teamwork (see sample rubric below)
- Ability to present information in an articulate way so that others can understand
- Ability to organize and express thoughts
- Ability to give clear explanations and directions
- On-topic response to questions posed by teacher or other students

Conclusions
Preliminary findings based on anecdotal data collected over the last eight months indicate that making engineering a part of the students’ educational experience provides a vehicle for practicing oral and written communication skills as well as experience in collaboration with peers. Students are given a purpose for communicating and cooperating with other students. They feel comfortable and successful in using the engineering design process.

The writing samples have not yet been evaluated. However, the teacher has observed that the students are becoming more skilled at using transitional words such as first, next, and then when writing directions on how to complete a task or reporting on procedures that were followed in a design challenge. They also appear to have a more positive attitude toward writing when it involves describing or reflecting upon an engineering experience.

It is the conclusion of this writer that engineering can be introduced to, and have a lasting impact on, special needs students. It is hoped that the results of this study will support this statement and will demonstrate the need and value of engineering education as a way to facilitate student achievement of 21st century skills in classroom settings.

Acknowledgments
This research project is funded by the National Science Foundation’s Mathematics and Science Partnerships Program. We thank Rebecca Anstadt, Jersey City teacher, for participating in this research.

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Table 1: Essential 21st Century Skills Defined by the Partnership for 21st Century Skills

Table 2: Sample rubric for pairs and group work

Written communication skills were assessed by portfolios containing samples of student work produced in conjunction with the engineering lessons that were maintained throughout the school year. Students were given a purpose for communicating and cooperating with other students. They feel comfortable and successful in using the engineering design process.