Developing Inclusive Outreach Activities for Students with Visual Impairments

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ABSTRACT

Despite advances in assistive technology, relatively few visually impaired students participate in university-level computing courses. Significant factors in this under representation include lack of relevant precollege preparation, lack of role models, access to resources, and the highly visual nature of modern computing. This paper describes the development of inclusive activities and materials for use in a summer workshop for precollege students with visual impairments. All activities utilized commercial technologies in the areas of robotics and programming using Lego Mindstorms NXT. The workshop activities are designed to provide a foundation in computing that encourages students to pursue computing in high school and beyond. In addition to activity design, initial results and lessons learned from the summer workshop will be presented.

Categories and Subject Descriptors

K.3.1 [Computers and Education]: Computer Uses in Education –collaborative learning, K.3.2 [Computers and Education]: Computer and Information Science Education –computer science education, K.4.2 [Computers and Education]: Social Issues – assistive technologies for peCompute4 $i–

ImagineIT workshop, offered to students in grades 7-12 who are visually impaired [4]. The 4-day workshop covered robotics programming, PC hardware, and game development. This scope of this paper is limited to the robotics activities using Lego Mindstorms NXT.

2.

5. The robot moves forward towards a sound source, touches the sound source and stops.

6. While there is sound, the robot moves forward towards the sound source, touches sound source and then turns left 90 degrees.

7. The robot moves forward toward maze wall, and turns left 90 degrees when the ultrasound sensor detects the wall at 25 cm. After the left turn, the robot plays a sound.

The handouts walk the students through each lesson, including the new concepts and the language features used. The source code is also commented, as shown in Figure 1. The screen reader software was set to read the punctuation in order for the students with low vision to understand the role of punctuation in programming. With each lesson, the students walked through the concepts and how to manipulate the BricxCC environment, in addition to the robot itself. All of the lessons were traversed in 3 to 4 hours by all four teams.

```
#include "Subroutines.nxc"
/**
* This program moves the robot forward
until it touches a wall with the touch
sensor.  When it does, it stops, moves
backwards for one second, then turns to
the right. It repeats this process three
```

In addition to the process, students were encouraged to follow roles during these activities in order to encourage participation from all students. The length of the activity and the use of

4.4.2 Conducting the Workshop

While having a set schedule for the activity was useful, being flexible in order to accommodate students who either needed extra help or who are exceptional was essential. Two teams completed the design challenge with time to spare. So an extra challenge was devised whereby the robot needed to navigate a path using a light sensor instead of the touch sensor. This extra challenge required the students to use their existing skills while learning the nuances of a new sensor.

The success of the activity would also not have been possible without each team having an assistant, whether the assistant was a workshop assistant or one of the authors. This arrangement allows for activity facilitation and ensured that all students were active in their respective teams.

Advice for others who are interested in using Lego Mindstorms NXT robots with visually impaired students also includes:

- Spending time orienting the students to the room, their work area, and the equipment is important.

- Space tables, chairs, etc. with enough space for students with canes to traverse the work area safely.

- The use of the rechargeable battery pack

- The use of Braille labels for the major components of the brick.

- The need for a sighted individual to help students with very low vision with menu navigation on the brick.

- Creating a reference list that will enable the facilitator to direct students who are using the Braille version of the handouts to the correct page quickly.

- The need for a large room or multiple small rooms to control the noise level. In addition to the students, screen readers also are speaking constantly.

5. NEXT STEPS

The workshop and activity set was piloted in Summer 2007. Both the event and the Lego Mindstorms activities were a success. With the positive results, the activities will be expanded to allow for similar activities, including those that can transition students to other computing topics in addition to advanced programming concepts. The use of Java will also be explored as skills in object-oriented programming can be immediately applied to high school and university course work.

6. ACKNOWLEDGMENTS

7. REFERENCES

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