

A New Mathematical Educational Software for the Visually Impaired or Blind Students

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Introduction

Blind and visually impaired students have historically lagged behind their sighted counterparts in mathematics competency. A college mathematics class can be one of the most challenging and frustrating subjects, particularly if the student's public educational history lacks the mathematical units necessary to be successful in the college mathematics classroom. For reasons not determined, the numbers of visually impaired and blind students enrolled in post-secondary institutions have decreased since 1996. Post-secondary service providers, who determine academic accommodations for the disabled post-secondary population as mandated by the Americans with Disabilities Act (ADA, 1990), haven't determined why the numbers are lower than other disability categories. One observation is that those students with normal intelligence and enrolled in the public school systems are not receiving the same levels of educational assistance that is available in specialized schools for the blind and visually impaired. Another observation is that despite the availability of educational technology that includes adaptive materials, there are not enough adequately trained educators. Consequently, many entering post-secondary institutions are unprepared in some subject areas, particularly in math and science. Currently, the existing technological tools available to blind and visually impaired students are either too complicated or not appropriate for this special population.

One of our **first goals** at the at Dona Ana Branch Community College (DABCC), a branch of New Mexico State University, was to create a bridge with elementary and secondary schools serving blind and visually impaired students. DABCC is a comprehensive community college and its mission is to enhance access to education and to prepare a high quality workforce in the community.

A **second goal** is the enhancement of the students' mathematical education. This is being accomplished by presenting a series of student workshops using software developed for the blind and visually impaired.

The **third goal** is to develop an evaluation mechanism that will demonstrate the success of this project. As part of the faculty and professional staff, we anticipate this project will initiate a series of educational proposals that will continue to reinforce the software & the proposed goals.

Finally, the **ultimate goal** is for this population of students to have an equal opportunity to explore and succeed in mathematics and in associated careers at Dona Ana Branch Community College and New Mexico State University.

Services for Students with Disabilities at DABCC

- Advance notice of books and resources require for each class, allowing the student time to arrange for taped, enlarged or Braille versions.
- Permission to use tape recorders, “talking” computers, or computer notetaking equipment in the classroom.
- Testing accommodations that include: extended time, taped exams, Brailled exams, readers, scribes, etc.
- Access to Braille printers, scanner systems, and adapted laptop computers.
- Access to talking calculators, raised-line drawings kits, four-track tape recorders, talking spell-checkers, laboratory equipment.
- Developing guidelines for accommodating the blind and visually impaired.
- Staying current with adaptive technology.

Target Population

1. Students employed by the project
 - a. 1 visually impaired student from Las Cruces Public Schools.
 - b. 1 visually impaired student from DABCC
 - c. 1 with no disability student from NMSU
2. Faculty employed by the project
 - a. 1 visually impaired faculty from DABCC
 - b. 1 with no disability faculty from DABCC
3. Four math instructors (with no disability) from the NM School for the Visually Handicapped and 2 math instructors from Albuquerque Public Schools.
4. Workshop participants
 - a. 10 visually impaired students from the NM School for the Visually Handicapped.
 - b. 3 visually impaired students from Doña Ana County.
 - c. 4 math instructors with no disabilities

Proposed Activity

To enhance the visually impaired/blind students’ mathematical education, a series of workshops will be provided to students and teachers on the interactive computer software tool “MUHANAD” and examples on how the software could be integrated into math lessons. The examples will be real life applications and tactile manipulatives. Other educational tools include teaching NEMATH Code, and “Math Speak”. In addition, create a bridge between Doña Ana Branch Community College (DABCC) and schools that serve blind/visually impaired students.

Description of Activities

The RASEM sponsored Project at DABCC was approved on May 15,2002. Since its implementation, the following activities were conducted.

1. A series of meetings were conducted between Las Cruces Public School officials and project coordinators. A math needs assessment list was created, and a mutual understanding of agreements was developed on providing workshops for students and teachers.
2. The project was presented to 20 administrators and teachers of special needs students from New Mexico on October 26, 2002 as part of “Teacher October Assistive Device Workshop” at DABCC.
3. Provided a one-day workshop at DABCC on mathematical concepts that addressed the identified needs and strengths of visually impaired students. The primary focus of workshop was to teach the operation of a scientific calculator for the visually impaired/blind students, with the title of “Scientific Calculator for the Visually Impaired/Blind Student Workshop.” Four visually impaired students and four teachers and teacher assistants attended the workshop.
4. The development of the interactive computer software tool, “MUHANAD” to assist students with the mathematical skills is in progress. First, we realize that the calculators available to visually impaired/blind students were inappropriate and expensive. The first step in creating “MUHANAD” was to design a scientific calculator as an accessory for the computer software tool. The second step was to program concepts from the Prealgebra and Beginning Algebra. The software uses text to speech technology to output message, and all keys as well as functions are voice activated by pressing them. The software was created using the object oriented programming language Visual Basic, and speech technology was accessed using advanced text to speech libraries.
5. Provided a one and one-half hour presentation at the 28th Annual Conference of American Mathematical Association of Two-Year Colleges (AMATYC) Nov. 2002 at Phoenix, Arizona. The feedback from the fourteen participants confirmed the need for such a tool, and the comments regarding modifications of the math educational tool for the blind were very helpful.
6. As part of workshops and presentations, we disseminated information on DABCC Services For Students with Disabilities, RASEM2, and DABCC academics programs.

Does it need any electronics?

- All necessary components will come in a CD.
- Software does not need any other machines but a computer.
- Software currently supports PCs using Windows 95, 98, ME, 2000 NT and XP.

How was this created?

- Software was created using the object oriented programming language Visual Basic.
- Speech technology was accessed using advanced text to speech libraries.

Relationship to Existing Services or Initiatives.

In each of the presentations and workshops we collaborated with DABCC Services for Students with Disabilities (SSD). It is important that participants are aware of the purposes, and the provided services including the available equipment at DABCC-SSD.

Persons Served

The project served both visually impaired/blind students and math faculty that teach visually impaired/blind students. Unfortunately, only four visually impaired students were served from Las Cruces Public Schools. Yet a large effort was dedicated towards the recruitment of these participants. This was accomplished by demonstrating our project to 38 teachers/teachers assistants, thus increasing awareness of this project and the needs of the visually impaired.

Requirements for Participants

The intent of the project was to serve visually impaired/blind students that are enrolled or are planning to enroll in PreAlgebra or Algebra courses and can operate the computer keyboard and math teachers of these students.

Recruitment and Completion

A large amount of effort was spent on recruitment. At first, the Las Cruces Public Schools have many students that are visually impaired or blind, but for reasons beyond our control, such as notice needs to be one month in advance, not all students are taking or planning to take Prealgebra or Beginning Algebra, and other policies of institution. We did not reach our recruitment goal to serve 40 students, but because of recruitment problems this goal was not met. Yet, the goal regarding the development of the math educational software tool was met.

Dissemination of Benefits

The current benefits from project are minimum, but in the future the dissemination of benefits or final outcomes of the project will be provided through different methods: First, through presentations in regional conferences dealing with math and/or disabilities such as NMATYC (New Mexico American Mathematical Association of Two Year Colleges) in Farmington, NM. Second, through a construction of WebPages that is linked to RASEM² Web Page. The potential benefits are short term, as well as long term outcomes.

Sustainability of the Project

The development of the math educational tool MUHANAD is in progress, institutions that serve visually impaired/blind students are beginning to be aware of the project. Our plan is to request space from DABCC to work on our project, and in the near future have some type of financial agreement with NM Commission for the Blind to support this partnership.

Project Staffing

The staffing of the project includes: one NMSU computer science major student who was responsible of programming MUHANAD, one NMSU computer science blind student was responsible for evaluating MUHANAD and one DABCC visually impaired student responsible for evaluating MUHANAD.

Lessons Learned

Recruitment of students was difficult, we learned that every institution has different policies, to recruit students you need to consider administration, teachers, parents and the liability of the students.

The comments from teachers state that they need assistance or training in teaching methods such as math speak, nemeth code, and the use of abacus. They also need assistance in transcribing math tests, worksheets for students.

Considering the comments of participants on MUHANAD, certain modifications to the design need to be considered: the scientific calculator needs to be separate from the interactive software, needs to be a standalone file. This would help blind students take standardized test.

Benefits Derived

Because we started late on the project, the benefits of project was minimal. We expect the benefits to increase next year with your help. Four CD's were distributed to students and three CD's were distributed to teachers containing the math educational software MUHANAD. Our plan is to keep in touch with these participants to keep them aware of new modification to software.

Coordinator Qualifications

Dr. Shakir Manshad graduated with a master degree in applied mathematics from the University of Manchester UK, in 1978. My Ph.D. degree is from NMSU, 1987, covering the areas of mathematical modeling, numerical analysis, operations research, computer vision theory and applications. My interest are helping blind students excel in math by developing computer software, giving workshops to train students in using the Texas Instruments Graphics Calculators and developing software for the calculator. I taught math high school for two years and taught math at colleges and universities for 10 years oversees.

Rene L Sierra in currently an Associate Professor at General Studies, DABCC. The teaching experience in math includes pre-calculus courses focusing in Developmental Math since 1994. My education includes a MS in Mechanical Engineering, and a BS in Civil Engineering both from NMSU. In 1991 I received a certificate of completion from NM Commission for the Blind Training on Life Skills at Alamogordo, NM.