Making Mathematics Accessible to All:
A Video, Website and Workshop
Employing Universal Design to Teaching Mathematics

Professional Development Grant
Requesting $8,000
April 1, 2007 through May 31, 2008

Principal Investigator
Stanley (Stan) Dick. PhD
Assistant Professor for Math Education
Center of Science and Math in Context
Dept. of Curriculum and Instruction
Stanley.Dick@umb.edu

Research Consultant
Marilyn Day, MA
Supervisor, Curriculum Resource Center
Healey Library
Marilyn.Day@umb.edu

Project Coordinator
Zary Amirhosseini, MA
Assistant Director
Ross Center for Disability Services
Zary.Amirhosseini@umb.edu

Universal Design Specialist
Kirsten Behling, MA
Project Coordinator of the E&E Grant
Kirsten.Behling@umb.edu

Accessibility Consultant
Valerie Haven, M.Div. and an MT
Access Technology Specialist
Adjunct Faculty – Distance Education
Valerie.Haven@umb.edu

Disability Advisor
Virginia (Ginny) Perelson, MA
Director, Ross Center for Disability Services
VirginiaL.Perelson@umb.edu

A Professional Grant Proposal to provide the University of Massachusetts Boston Mathematics Faculty with a Professional Development opportunity to Make Math Accessible to all students, including those with visual impairments.

PROJECT SUMMARY

The proposed professional development project, *Making Mathematics Accessible to All: a Video on Universal Course Design Principles and the Application to Teaching Mathematics* will address the instructional difficulties facing faculty at UMass Boston who are teaching mathematics to all students, particularly including those with visual impairments. To promote Universal Course Design (UCD) with mathematics faculty:

- A video will be developed to provide awareness and examples of UCD.
- A website will be developed for ongoing technical assistance to faculty.
- A workshop will be held to showcase the video and educate faculty regarding available resources and support both on and off campus.

The core Universal Course Design team was created at UMass Boston in response to the goals of the federally-funded *Equity and Excellence in Higher Education* grant. This UCD team is charged with increasing the awareness of Universal Design throughout the university community. An emerging focus of this team is addressing the education needs of students with visual impairments, particularly related to teaching mathematics. The need for additional resources to assist students with visual impairments to learn mathematics is widely recognized by students and faculty. The highly visual nature of teaching math is not conducive to learning for these students. UCD is a faculty professional development model that provides strategies for effectively reaching all learners. The UCD model includes easy-to-incorporate strategies around course design, instruction, assessment and the environment in which the course is taught.

_____ _____

Signature of Investigator's Department Chair or Program Director date

_____ _____

Signature of Investigator's Dean date

_____ _____

Signature of campus Provost date

2. PROJECT NARRATIVE

Educating students with disabilities in mathematics has been problematic for many years. The discipline of mathematics has been a particular challenge to students with visual impairments due to the highly visual nature of complicated mathematical formulae. However, with the appropriate instructional format and a combination of individualized accommodations students with visual impairments are fully capable of achieving in mathematics.

The traditional method of instruction, lecture and board work, create unnecessary obstacles for students with visual impairments often leading to a significantly higher failure rate than their peers with full sight. Students with visual impairments, who receive individual accommodations at the University of Massachusetts, have reported to the Ross Center that their inability to fully access math courses has deterred them from feeling fully prepared for future math courses and choosing math-based careers. More specifically two students with visual impairments recounted their math course experiences:

> "I had last taken Calculus twenty years previous while I was sighted. The span in years and change in perspective from visual to oral left me unprepared to manage the complexities of higher mathematics."
> And

> "The difficulty that I had was that math is a very visual subject, specifically in the areas of algebra, geometry, and other higher levels of math. Being significantly visually impaired hindered my ability to gain the maximum from the course."

As college classrooms fill with increasingly diverse learners (students from different cultural backgrounds, academic preparedness, and those with disabilities), all faculty are faced with the challenge of providing equal access to their courses. However, even as faculty members work to align their instructional strategies with those of the diverse learning needs of their students, they are often not aware of the instructional resources and technology available to assist them. In order for all students, including those with visual impairments, to successfully access a math course it is important for faculty to know what instructional practices will better meet the learning needs of a diverse student body. Many math faculty members at UMB have indicated that they had a number of pedagogical problems when teaching students with visual impairments. When asked what might help, most of these faculty members requested more information and support to better educate these learners.

Currently there is a trend occurring nationally to address the pedagogical chasm existing in certain academic disciplines for all students, including those with disabilities. These fields are Science, Technology, Engineering, and Mathematics (STEM). Organizations such as the National Science Foundation and WGBH's National Center on Accessible Media are actively investigating how to solve the problems of educating all students and in particular those with disabilities in these areas.

One of the most promising educational practices emerging to ameliorate the difficulties in mathematics encountered by students with visual impairments is Universal Course Design. Universal Course Design (UCD) was developed by the Institute for Community Inclusion at the University of Massachusetts Boston as a result of eight years of federally funded research (Office of Postsecondary Education, U.S. Department of Education grant # P333A050051). Universal Course Design promotes the development of educational models which create inclusive learning environments for all learners. This is accomplished by designing course curriculum, instruction, assessment and then the environment in which the course is taught, to be fully accessible to all learners, including those with disabilities. UCD requires faculty to think about different methods of teaching and offering course material in more than one manner. For example a lecture should be combined with hands-on student centered learning opportunities, and a text book should be complimented by computer software or online journals, etc. Providing course materials, instruction and assessment in multiple formats allows the individual learner to access the information in the manner that best suits his or her learning style. UCD has led to increased student engagement and improved individual achievement in coursework. UCD is built on the premise that the entire educational experience should be designed to create an inclusive learning environment. For more information about UCD please visit the E&E project website: www.eeonline.org.

3. PROJECT DELIVERABLE

The Equity and Excellence Committee (E&E Committee) was developed in response to a federally funded grant designed to bring UCD strategies to college campuses to increase access to college courses for all students. The E&E Committee is composed of representatives from the library, instructional technology departments, the Ross Center, the Institute for Community Inclusion, and a variety of faculty working to incorporate UCD strategies into their courses. The committee meets once a month to discuss how to help faculty learn about and incorporate UCD strategies into their courses. Since the committee was formed, over a year ago, it has created a UCD informational video, given four workshops, and advised over 10 individual faculty members on how to make their courses accessible to all.

The E&E Committee proposes, with the assistance of this grant, to address the difficulties that the University of Massachusetts Boston (UMB) faculty members have experienced in teaching mathematics to students with visual impairments. The primary goal of this project is to develop comprehensive UCD resources for math faculty to address the difficulties of effectively teaching students with visual impairments. The E&E Committee will fulfill this goal by 1) compiling educational strategies for students with visual impairments, 2) creating a UCD video which highlights UCD strategies for effectively working with students with visual impairments, 3) creating a website for faculty to refer to for technical assistance and 4) providing faculty with at least one workshop that introduces UCD and provides faculty with personalized solutions to working with students with visual disabilities.

1) Compiling educational strategies for students with visual impairments:
The E&E Committee will first assemble their combined expertise and knowledge in the area of making mathematics accessible to those with visual impairments. They will then compile resources from organizations specializing in UCD and in accessible teaching practices and tools in the field of mathematics. A literature review will also be done to ensure that no viable strategies have been missed. In addition, grant staff will interview UMB mathematics faculty, students and teachers of the visually impaired to determine the best practices for effectively engaging students with visual impairments.

The UCD strategies that are identified as beneficial for math courses will be categorized by their effectiveness with, and ease of use by specific target audiences of visually impaired students. They will further be sorted by their utility to other, more general learners of mathematics. This delineation of strategies and their uses will be made available in written format which will be passed out at the workshop and made available on the project website.

2) Creating a UCD video which highlights UCD strategies for effectively working with students with visual impairments:
The E&E Committee will, employing the UMB Distance Learning Video Production Center, develop a video highlighting the UCD strategies that UMB faculty are already using and suggestions for additional instructional techniques to make math accessible to students with visual impairments. The video will interview two or three math professors, teachers of the visually impaired and students about the methods that they have used and found successful when working with diverse learners, including students with visual impairments. Each interview will be accompanied by narrated information about UCD and its benefits to all students. The video will be available for all math faculty members in DVD format, on the project's website and will be used in subsequent faculty trainings and workshops. The Committee has some expertise in the development of videos as it has already successfully developed an informational video about UCD at UMB.

3) Creating a website for faculty to refer to for technical assistance:
The E&E Committee will develop a website aimed at helping faculty make mathematics accessible to all students, including those with visual impairments. The website will be developed with input from the E&E Committee, math faculty, teachers of the visually impaired and students. The goal of the website is to serve as a resource for faculty as well to provide ongoing training and technical assistance. The website will also contain the UCD Making Math Accessible video, a blog which will allow faculty to share their experiences and learn from each other and a data base of UCD strategies developed by math faculty. The website will be developed by a graduate assistant with direct guidance from the Principal Investigator and the E&E Committee. The website will be hosted on the Institute for Community Inclusion's server to ensure its sustainability beyond the life of the grant.

4) Providing faculty with at least one UCD informational workshop:
Finally, the E&E Committee will develop one or more workshops for any interested faculty, but especially for mathematics and mathematics education faculty. The Principal

Investigator will recruit and involve students with visual impairments in the process of designing and conducting a workshop for mathematics faculty who want to learn more about UCD and teaching students with visual impairments. The workshops will discuss the difficulties of effectively educating students with disabilities and highlight UCD strategies as methods for making math accessible to all. The video and website will be shown in the workshops.

4. DISSEMINATION OF PROJECT RESULTS

The E&E Committee led by the Project Director, will be responsible for disseminating the materials developed by the project staff to a wide audience. In addition to creating a video, website and hosting UCD informational workshops, this project will disseminate project activities at UMB and other institutions of higher education nationally.

The UCD Making Math Accessible video will be shown to the math faculty and other faculty members who express an interest in learning more about UCD. It will also be hosted on the project website, as well as the E&E website. The Principal Investigator will attend the math departmental meeting to introduce UCD and the video, and will refer faculty members to the website and the E&E Committee for further training and technical assistance. The Making Math Accessible website will be available for all faculty members. A link to it will be available on the following websites: The Ross Center, The Institute for Community Inclusion, the E&E grant, the Northeast Regional Center for Vision Education as well as any other location identified by the faculty we work with. The materials for the workshops will be available on the project website. We will also ensure that they are replicable for other colleges to use in their own workshops.

Finally, it is the intention of the Principal Investigator to use this grant as a pilot for further funding. Once the video and website are developed we plan on using them when communicating with the STEM project, National Science Foundation and the US Department of Education, Office of Postsecondary Education to propose future projects in the area of making science, technology and engineering fully accessible through the use of UCD. Finally, the project staff intends to disseminate the video and website at workshops given at other University of Massachusetts campuses. It is also our intention to present our products at the Association for Higher Education And Disability (AHEAD) and National Council of Teachers of Mathematics (NCTM) conferences.

While the proposed project would have a powerful effect on the ability of visually impaired students to get a better mathematics education, the effect of the activities proposed here would have important implications for all students of mathematics. Many students, while not diagnosed with recognized or known disabilities, have trouble comprehending examples and discussions relating to mathematics. In addition, there has been a trend in this day of multi-media access, for students to rely less and less upon written text, and attempt to learn mathematics through other means. While this may be disturbing to the mathematics faculty, it is nevertheless a reality. Because many of the strategies that help visually impaired students are not based upon written text, they are

especially helpful to these struggling students. Using multi-sensory tools to demonstrate mathematical learning objectives will not only decrease the apprehension of students with visual impairments, it will also enhance the overall accessibility of the information to the entire class.

5. BUDGET AND BUDGET JUSTIFICATION

University of Massachusetts Boston
Information Technology Council
Enhance Learning Through the Use of Technology

A Video, Website and Workshop
Employing Universal Design to Teaching Mathematics

Personnel	Match UMB	Total
Principal Investigator, Stanley Dick, Summer Salary		$1,000
Project Coordinator. Z. Amirhosseini	In-kind	$0
Accessibility Consultant, V. Haven	In-kind	$0
Research Consultant, M. Day	In-kind	$0
UD Specialist, K. Behling	In-kind	$0
Disability Advisor, V. Perelson	In-kind	$0
Graduate Assistant		$ 2,000
Total Salary		**$ 3,000**
Supplies	In-kind	$0
Video production, UMB Distance Learning Video Production Center		$5,000
Total Project Costs		**$8,000**

Principal Investigator, Stanley Dick**,** will be responsible for ensuring that all project activities are completed as specified in the proposal, timelines are strictly observed, and that the project achieves its intended outcomes. Dr. Dick will coordinate all math department workshops, identifying faculty video participants and work with the team to maximize dissemination activities. This project requests $1,000 to support Dr. Dick's time during the summer.

Project Director, Ms. Amirhosseini, will help the Principal Investigator coordinate all project related activities. She will assist in the production of the workshops, video and websites, ensuring that each is finished in a timely fashion. She will also oversee the recruitment of faculty and student video participants. Ms. Amirhosseini's time is given in-kind.

Accessibility Consultant, Valerie Haven, will be responsible for educating the math faculty about the assistive technology needs of students with visual impairments. She will introduce faculty to various instructional strategies, including technology, which

can be used in the classroom to ensure access for all. She will advise the project on the content of the workshops, video and website in regards to accessibility for all. Ms. Haven's time is given in-kind.

Research Consultant, Marilyn Day, will assist the project in locating all research materials on teaching math in higher education, accessibility issues with math courses and information around different instructional methods proven to be effective for reaching all learners. Ms. Day has a Master's Degree in Rehabilitation Teaching for the Blind and a wealth of resources available to her through her position as a librarian. Ms. Day's time is given in-kind.

UD Specialist, Kirsten Behling, will advise the project on all universal design materials. She will assist the Principal Investigator with the design of the workshop, and guide the direction of the video and website. Ms. Behling will also offer individual technical assistance to faculty as needed while they learn about and implement the principles of universal design in their course work. Ms. Behling's time is given in-kind.

Disability Advisor, Victoria Perelson, will advise the project on disability related issues. She will advise faculty on their role as faculty members working with students with disabilities as well as offer strategies and resources from the Ross Center. Ms. Perelson will guide the project as it creates the workshop, video and website and will offer technical assistance to faculty as needed. Ms. Perelson's time is given in-kind.

Graduate Assistant will be responsible for working with the project to create an informative universal design mathematics website. He/she will have website building skills and will take direction from the project director. This project is asking for $2,000 to support the graduate assistant.

Supplies: Supplies will be provided in-kind from the varying offices that the project staff members represent.

Video Production: ***The University of Massachusetts Distance Learning Video Production Center*** has estimated that a video will cost $5,000. This project requests the full amount to support the development of the video.

6. PROJECT TIMETABLE:

Making Math Accessible:
Employing Universal Design to Teaching Mathematics

	Lit. review	Video	Website	Workshop	State & National presentations	Interim Report	Final Report
04/07	Begin						
05/07			Hire a Graduate Assistant				
06/07	End	Identify faculty & students for interviews	Design the layout of the site				
07/07		Write UCD informational script	Identify contents to be included	Design a workshop			
08/07			Build the site	Conduct a UCD website			
09/07		Interview faculty & students	Edit the site as necessary				
10/07		Edit video					
11/07		Edit video					
12/07						Due	
01/08		Video premier at CIT conference		Conduct a UCD website	CIT conference		
02/08		Video showed at Math departmental meeting			Presentations to other UMass campuses		
03/08							
04/08							
05/08							
06/08							Due

7. PRINCIPAL INVESTIGATOR, PARTICIPANTS AND QUALIFICATIONS (See attached letters of commitment)

Principal Investigator- Stanley Dick

Project Coordinator – Zary Amirhosseini

Accessibility Consultant – Valerie Haven

Research Consultant –Marilyn Day

UD Specialist – Kirsten Behling

Disability Advisor – Virginia Perelson

Brief Relevant Qualifications for the Principal Investigator, Stanley Dick

Ph.D., Mathematics, Adelphi University
M.S., Mathematics, Adelphi University
B.S., Mathematics and Physics, Hunter College of the City University of New York

Assistant Professor for Mathematics Education
Center of Science and Mathematics in Context (COSMIC)
Department of Curriculum and Instruction
Graduate College of Education

Dr. Dick teaches all of the mathematics education courses taught in the Graduate College of Education

Since 2004 Dr. Dick has been a regular presenter at Mathematics Workshops for Teachers of the Visually Impaired presented by the Carroll Center for the Blind and the Perkins School for the Blind.

LETTERS OF COMMITMENT

UNIVERSITY of
MASSACHUSETTS
BOSTON
100 Morrissey Blvd.
Boston, MA 02125-3393

Ross Center for Disability Services
(617) 287-7430
Fax: (617) 287-7466
TTY: (617) 287-7430

February 15, 2007

Stanley Dick
University of Massachusetts Boston
100 Morrissey Blvd.
Boston, MA 02125

Dear Dr. Dick,

I hereby state my commitment to your proposed project, Making Math Accessible: Using Universal Design in Teaching Mathematics to Students with Visual Impairments. More and more of students with disabilities are entering the math and science arenas and accessibility is an important issue to consider as far these individual's educational plans. I applaud you and the E&E committee in thinking outside of the box in order to find new and creative ways to ensure academic access for students who are blind or visually impaired.

I understand that as a Disability Specialist and the Assistant director of the Ross Center, my role will be to assist you in designing and developing the video and website which will ultimately be used as a tool for faculty in the mathematics program here at UMass. I will also assist in recruiting faculty and students with disabilities who would be interested in participating in the project.

I look forward to assisting you with this important initiative. I believe your work will provide much needed instructional strategies to math faculty while leveling the playing field for all students enrolled in math courses.

Sincerely,

Zary Amirhosseini

Zary Amirhosseini
Assistant Director
Ross Center for Disability Services

UNIVERSITY of
MASSACHUSETTS
BOSTON
100 Morrissey Blvd.
Boston, MA 02125-3393

Institute for Community Inclusion
(617) 287-4300
Fax: (617) 287-4352
TTY: (617) 287-4350
Email: ici@umb.edu
www.communityinclusion.org

February 15, 2007

Stanley Dick
University of Massachusetts Boston
100 Morrissey Blvd.
Boston, MA 02125

Dear Dr. Dick,

I am writing to assure you of my commitment to your proposed project, Making Math Accessible: Using Universal Design in Teaching Mathematics to Students with Visual Impairments. Your efforts to find new and creative ways to ensure that all students, including those with visual impairments have equal access to Math courses is critical in today's diverse student population.

I am thrilled and honored to serve as a Universal Design Specialist for this particular project. I understand that as a Universal Design Specialist my role will be to guide you as you develop informative Universal Design workshops, a video and a website. I am also pleased to offer technical assistance where you see fit throughout the span of this proposed project.

I look forward to assisting you with this important initiative. I believe your work will provide much needed instructional strategies to math faculty while leveling the playing field for all students enrolled in math courses.

Sincerely,

Kirsten Behling
Universal Design Specialist
UMass Boston/ ICI

UNIVERSITY of
MASSACHUSETTS
BOSTON
100 Morrissey Blvd.
Boston, MA 02125-3393

Ross Center for Disability Services
617.287.7430
Fax: 617.287.7466
617.287.7430 VP/TTY

February 15, 2007

Stanley Dick
University of Massachusetts at Boston
100 Morrissey Blvd.
Boston, MA 02125

Dear Dr. Dick,

This letter is to confirm my commitment to the proposed project, *Making Math Accessible: Using Universal Design in Teaching Mathematics to Students with Visual Impairments*. The project will contribute to innovative strategies for creating access to the field of mathematics for students who have visual impairments, and in fact, for all students.

I am pleased to be asked to serve as Disability Advisor to the project. I understand my commitment to be:

1. To contribute relevant information regarding the impact of existing barriers in math instruction for students with disabilities.
2. To assist in recruiting students to participate in the project.
3. To promote the concepts and principles of UCD as Director of the Ross Center for Disability Services.

I am excited about working together with you on this project to make a real difference for all students who are learning math.

Sincerely,

Virginia Perelson
Director, Ross Center for Disability Services
UMass Boston

UNIVERSITY of
MASSACHUSETTS
BOSTON
100 Morrissey Blvd.
Boston, MA 02125-3393

Institute for Community Inclusion
(617) 287-4300
Fax: (617) 287-4352
TTY: (617) 287-4350
Email: ici@umb.edu
www.communityinclusion.org

February 20, 2007

Stanley Dick
University of Massachusetts Boston
100 Morrissey Blvd.
Boston, MA 02125

Dear Dr. Dick,

I am writing to pledge my commitment to your proposed project, Making Math Accessible: Using Universal Design in Teaching Mathematics to Students with Visual Impairments. Exploring creative ways to ensure that all students, including those with visual impairments have equal access to high quality mathematics education is essential in today's diverse student population.

I will be delighted to serve as an Access Technology Specialist for this project. I understand that as an Access Technology Specialist my role will be to assist math faculty in learning about the assistive technology needs of students with visual impairments. I will introduce faculty to various instructional strategies, including technology, which can be used in the classroom to ensure access for all. I will also advise the project on the content of the workshops, video and website in regards to accessibility for all.
I look forward to assisting you with this important initiative. I believe your work will provide much needed instructional strategies to math faculty while creating an inclusive learning environment for all students enrolled in math courses.

Sincerely,

Valerie Claire Haven
Access Technology Specialist
UMass Boston/ ICI

February 16, 2007

Stanley Dick
University of Massachusetts Boston
100 Morrissey Blvd.
Boston, MA 02125

Dear Dr. Dick,

I am writing to state my support for your proposed project: Making Math Accessible; Using Universal Design in Teaching Mathematics to Students with Visual Impairments. It is my understanding that access to mathematics has historically been problematic for undergraduate and graduate student with visual impairments. Likewise, mathematics faculty members who have visually impaired students in their classes, face definite challenges.

This project has the potential for easing the difficulties mentioned above and providing important support to mathematics faculty who have students with visual impairments in their class. The proposed video and website will demonstrate techniques and provide resources towards this goal.

As the Supervisor of the Curriculum Resource Center at Healey Library, I look forward to being a Research Consultant for this project. Through my library experience, I have seen the importance of creating academic accessibility for students with disabilities. Additionally, I have a Master's Degree in Rehabilitation Teaching for the Blind and I will bring my experience to this project.

I very much appreciate the expertise you bring to this project, Stan, as a mathematics professor who has been creatively working to make your classes accessible to visually impaired and blind students. I have enjoyed hearing about your presentations at Carroll School and Perkins School for the Blind, regarding accessibility issues and mathematics instruction.

It will be my pleasure to assist you with this project.

Sincerely,

Marilyn Day

Marilyn Day
Supervisor, Curriculum Resource Center
Healey Library
100 Morrissey Boulevard
Boston, MA 02125-3393

LETTERS OF SUPPORT

UNIVERSITY of
MASSACHUSETTS
BOSTON
100 Morrissey Blvd.
Boston, MA 02125-3393

Ross Center for Disability Services
617.287.7430
Fax: 617.287.7466
617.287.7430 V/TTY

February 12, 2007

Dr. Stanley Dick
Assistant Professor
University of Massachusetts at Boston
100 Morrisey Blvd.
Boston, MA 02125-3393

Dear Dr. Dick,

I am writing this letter to express full support for the Professional Development grant to develop resources for faculty to enhance math instruction for students with blindness and visual impairments. As Director of the Ross Center for Disability Services, I am aware of the complexity of the challenges faced by these students taking courses in math.

A video that demonstrates examples of Universal Design in instruction to address these challenges will be an excellent tool for faculty and staff. In partnership with faculty at UMB, the Ross Center will continue to provide information to increase accessibility to all available educational opportunities for students with disabilities.

Sincerely,

Virginia L. Perelson
Director, Ross Center for Disability Services

University of Massachusetts Boston

[redacted]

Distance Learning Video Production Center 100 Morrissey Blvd. Boston, MA 02125-3393

February 20, 2006

Stanley Dick Professor of Mathematics University of Massachusetts Boston Boston, MA 02125-3393

Stan,

I would like to take this opportunity to strongly endorse your proposal to produce an instructional video that demonstrates examples of Universal Course Design for all students including those with visual impairments. The Distance Learning Video Production Center at Umass Boston is a full service video production facility and has always been very active in assisting UMB faculty and staff in creating instructional video programs. The DLVPC would love to collaborate with you on this project and can provide you with broadcast quality production and post production services to ensure that your finished program is a success. We believe we can work within the budget constraint put forth of $5,000.00 to produce this program.

Sincerely,

John C. Jessoe, Director Distance Learning and Video Production Center

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