brock international prize in education

2013 Brock International
Prize in Education Nominee

Marilyn Irving

Nominated by L. Octavia Tripp

Dr. Marilyn Irving

Associate Dean for Research and Sponsored Programs

Howard University

School Of Education

Washington DC

Dear Jurors,

I am pleased and proud to introduce my nominee for The Brock International Prize in Education. Dr. Irving is an inspiration to many and has truly been a catalyst for education reform in Science Education. As STEM Education becomes a leading issue in educating the future generation of scientists in United States, Dr. Irving has devoted her time and energy to supporting, developing, and implementing programs that directly and indirectly serve as a means of increasing student interest in science.

I believe that she is an exceptional candidate for the Brock Award because she epitomizes what the Brock International Prize in Education recognizes as a key factor for innovations in the education system. She has made a major contribution to science education through grants, professional development, seminars, research, and the training of teachers and preservice teachers in math, science, and pedagogical skills related to effective preparedness in the classroom. She has made several contributions to the health field by developing activities that stimulate awareness of the danger of diabetes, stroke, and hypertension to middle school students by alerting them that changing their lifestyle can be beneficial to preventing these potential deadly diseases.

It is worth mentioning the Dr. Irving has devoted most of her career in higher education creating professional development opportunities for teachers in science and math, training and retraining teachers from high content areas to teach in high needs schools, and has conducted research in the field of health and science that has lead to the development of institutes, seminars, workshops for teachers, community groups, and research.

Lastly, Dr. Irving in and effort to motivate student to learn science and math has collaborated with Dr. William (Bill) Crosby to speak out against bullying. Dr. Irving and Dr. Cosby have been on "Larry King Live" on CNN to discuss the topic of bullying. She also appears on local TV programs to speak about the effects of bullying on children and adults and suggests ways to stop bullying behaviors. In her collaboration with Dr.

Crosby, she has developed curriculum that addresses bullying, low self-esteem, and depression using the Fat Albert and Crosby Kids as part of her character education mission of promoting ethical and moral values in our Nation's youth.

As I step back and look at Dr. Irving's accomplishments I immediately think about the quote " Aim for the moon, even if you miss, you will land among the stars". Dr. Irving in her endeavors is aiming for the moon and as she travels in that direction she is brightening many stars on her way. Please take a moment and view her accomplishments.

Thanks,

Dr. L. Octavia Tripp
Associate Professor
Elementary Science Education
Auburn University
Auburn Alabama

Curriculum Vita

Dr. Marilyn Irving

CURRICULUM VITAE

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Education

1987	**Ed.D.**, Higher Education Administration, Texas Southern University, Houston, Texas
1976	**M.S.**, Secondary Science Education, Texas Southern University, Houston, Texas
1974	**B.A.**, Biology/Chemistry, Grambling State University Grambling, Louisiana

Academic Appointments – Howard University

2010 - Present	Associate Dean for Research and Sponsored Programs
2009 - Present	Full professor, Science Education Graduate Faculty, 1998 to present
2001 - 2008	Associate Professor, Department of Curriculum and Instruction School of Education, Howard University, Washington, DC Courses: Integrated Mathematics, Science and Technology Methods II Field Work and Seminar Theories and Principles of Curriculum Development Teaching Science in Urban Secondary Schools Elementary Education, Coordinator
2008 - 2010	Interim Chair, Department of Curriculum and Instruction
2005 - 2007	Associate Dean, School of Education, Howard University Washington, DC
1996- 2001	Assistant Professor - Science Education, School of Education Howard University, Washington, D.C.

1998- 2000 Director of Even Start Family Literacy Program
Planned and coordinated reading activities for parents and children to increase their reading level

1993-1996 Senior Training/Technical Assistance Associate
Southwest Educational Development Laboratory
Southwest Consortium for the Improvement of Mathematics and Science Teaching, Austin, Texas
Planned, coordinated, and conducted training and technical assistance for regional teachers, including intensive summer training sessions in mathematics and science. Assisted in the planning and delivery of regional forums on systemic reform in mathematics and science. Conducted literature reviews on science and mathematics reform. Collected information and prepared written materials for dissemination to regional and national audiences. Identified promising southwest region programs in mathematics and science education and responded to request from local school staffs for technical assistance in identifying, selecting, and implementing effective instructional programs in mathematics and science. Assisted in the preparation of information brochures, bulletins, and technical reports. Traveled extensively.

1994-1996 Adjunct Professor, Curriculum and Instruction, Science Education
University of Texas at Austin, Austin, Texas

1988-1993 Assistant Professor, Curriculum and Instruction, Science Education
University of Wisconsin-Whitewater, Whitewater, Wisconsin
Directed teaching (supervision of elementary and secondary student teaching)
Director, Observation and Participation
Methods Block
Young Scholars Program - Science - Grades 2-4
Mathematics and Science Institute - Grades 6-8

Supervised student teachers on elementary and secondary levels; advised graduate and undergraduate students; designed teacher development and
training programs, conducted workshops and in-services; chairperson on search and screen committee; active and involved in faculty governance, department, college, and university level; served on numerous academic, local, state, and national committees; provided lectures and presented papers at local, state, and national conferences; successful grant proposal writing experience; and active member of professional organizations.

1982-1988 Biology and chemistry teacher, Willowridge High School, Sugar Land, Texas
Curriculum developer in science in the district; developed lab manual for district; chairperson of textbook committee; sponsored

student extracurricular activities, and mentored students in science competitions.

Other Affliation: Fat Albert and the Cosby Kids Character Education Program in conjunction with Bill Cosby, educator and entertainer

Research

Refereed Publications:

Irving, M., Johnson, A., Nti, M. and Johnson, W. (**February 2009**). Assessing secondary science teachers' perceptions on teaching students with disabilities. *Journal of the Research Association of Minority Professors.*

Irving, M., Dickson, L.A., and Austin, W. (2008) (**Under review.**) Interdisciplinary efforts used to improve student proficiency in science, technology, engineering and mathematics (STEM). *The Black College Review Journal.*

Dickson, L.A., and **Irving, M. (In press).** Inquiry-based learning for secondary Biology teachers. *Journal of National Association of Biology Teachers.*

Irving, M., Nti, M. and Johnson, W. (2007). Meeting the needs of the special learner in science. *International Journal of Special Education*, 22(3), 109-118.

Irving, M. (2003). Part II: How I Succeeded in Graduate and Professional School and in my Career Path, Essay 21: Mentoring in the Advising Process. The Black Student's Guide to Graduate and Professional School Success. Edited by Vernon L. Farmer, foreword by Carol Moseley-Braun, Greenwood Press.

Irving, M., and Dickson, L. (2003). Chapter 6: Using relevant pedagogy: Recognizing student diversity to enrich learning science in the college classroom. Teaching culturally diverse college students in a pluralistic society, edited by Vernon L. Farmer and Evelyn S. Wynn, Wyndham Hall Press, p. 107-118.

Dickson, L, Jr. and **Irving, M**. (2002). "An Internet survey: Assessing the extent middle and high school teachers use the internet to enhance science teaching."*Journal of Computers in Mathematics and Science Teaching*, 21(1), 77-95.

Irving, M. (2002). Essay 21. Mentoring in the advising process. The Black Student's Guide to Graduate and Professional School Success. Edited by V.Farmer. Greenwood Press.

Irving, M. (2001). Chapter 4 "Critical Barriers to Scientific Literacy." Chapter 14 "Preparing Teachers to Work with Diverse Student Populations." Developing Literacy Skills Across the Curriculum, Practical Approaches, Creative Models, Strategies, and Resources edited by Jaggers, L., McJamerson, N. and Duhon, G., Edwin Mellen Press.

Irving, M., Dickson, L., Jr. and Keyser, J. (2000). "Retraining secondary science teachers in a diverse school district by upgrading knowledge in content and pedagogy." *Journal of Negro Education*, 3 (68), 409-418.

Irving, M. & Dickson, L. (Fall 1999). "Blending content and pedagogy to upgrade secondary science teachers' skills." *Education Issues*, 10 (1), 15-27.

Irving, M. & Dickson, L. (Fall 1999). Designing professional development courses to help science teachers adapt their teaching methods to students of varied ethnic backgrounds. *The Multicultural Science Educator Informer* 6, (2), 5-7. Association for Multicultural Science Education – National Science Teachers Association Affiliate

Irving, M. (2000). Book Review. Being responsive to cultural differences: How teachers learn? *Journal of Education for Students Placed At Risk (JESPAR)*, (3), 319-321. Lawrence Erlbaum Associates, Inc.

Irving, M. (1998). Analysis of effective professional development models in mathematics, science and technology in an urban school district. *Research Association of Minority Professors Journal*, 2 (2), 20.

______(1994). Environmental resource packet: A hands-on approach for primary/middle school teachers. R&M Publishing Company, Holly Hill, South Carolina. Website address: amazon.com Search: Marilyn Irving and click.

_______ (1994). Water, water… it's our business. Through the rainbow children science and literature. Council for Elementary Science International and National Science Teachers Association, Washington, DC.

Scholarly Work

"Integrating Mathematics, Science, and Language Arts with Astronomy" Mini book compiled by Middle and Junior High School Teachers, District of Columbia Public Schools, Washington, DC **(Edited)**

Irving, M. (1999). Implementing Design Engineering Activities (K-14). Junior Engineering Technical Society (JETS). Website address: http://www.engineering net.org/jets/nedcpmr.htm

Irving, M. (1999). Chemistry in a ziplock bag. Project Kaleidoscope. Website address http;//www.pkal.org/10thann/index.html

Educational Materials Developed

Irving, M. (2006). Toolkit on CD: "Increasing Underrepresented Minorities in Mathematics: An Informing, Encouraging and Reinforcing Three-Tier (IER) Program". Funded by General Electric.

Irving, M. and Austin, W.L. (2004). Toolkit: Project DiSH: Diabetes, Stroke and Hypertension, Activities for Middle School Science and Health Teachers on Awareness, Risk and Prevention of Diabetes, Stroke and Hypertension. (Support with funds from NIH). District of Columbia Public Schools and Prince George's County Public Schools.

Irving, M. (2004). Astronomy Activity Booklet: Mathematics, Science, and Language Arts (Supported with funds from U.S. Department of Education). District of Columbia Public Schools.

Irving, M. (2001). Research presentation: "Howard University – Internet Survey – "Assessing the Extent Middle/High School Teachers Use the Internet to Enhance Science Teaching". Presented at the Twentieth Annual Research Association of Minority Professors Conference, February 2001.

Irving, M. (**Reviewed).** Development of literacy and science literacy in culturally diverse students in introductory biology courses. *University of California Electronics Journal.*

Irving, M. **(Reviewed).** Motivating non-traditional minority adult learners to take responsibility to learn and use technological resources in an online course. *Journal of Research Association.*

Monograph Reviews

Panelist for HER/DRL – National Science Foundation. (February 2010).

The African Diaspora: Developing Black Scholars in Science Education for the 21st Century. (June 2009). A consortium of science educators – funded by the National Science Foundation.

Reviewer for Allyn and Bacon (2008).
Irving, M. Book Review. (2005). Access and opportunities to learn are not accidents. The Southeast Eisenhower Regional Consortium for Mathematics and Science Education (SERVE).

Irving, M. Book Review. (2004). Turning despondency into hope: Charting new paths to improve students' achievement and participation in science education. The Southeast Eisenhower Regional Consortium for Mathematics and Science Education (SERVE).

Grants Funded

"Ready to Teach," $2.1 million dollars, U.S. Department of Education (2007 -2012).

"Increasing Underrepresented Minorities in Mathematics: An Informing, Encouraging and Reinforcing Three-Tier (IER) Program" funded by General Electric, $210,000, (2005-2007). College of Engineering, Architecture and Computer Sciences, **Co-Project Leader.**

"Science and Mathematics for All," funded by the National Science Foundation, $352, 938, June 2004 to June 2007. Increasing the number of minorities teaching mathematics and science in partnering school districts. **Principal Investigator.**

Developing Teacher Leaders, funded by the National Science Foundation, $1,155,543.00, **Principal Investigator.** June 2001 to June 2004. Extension granted until June 2005.

Mathematics, Science and Language Arts Institute, Teacher Quality Grant, funded by the United States Department of Education, $67,000, **Principal Investigator**. June 2003-June 2004.

Easing the Transition into the Classroom: Building Capacity for Recruiting and Preparing Prospective Candidates to Teach in an Urban Setting, Howard University Fund for Academic Excellence, $5,978. April 2001 to May 2001.

Earth Science: Global Search for Water funded by Dwight Eisenhower Fund, $70,000. **Principal Investigator.** Spring 2001 – Spring 2002.

Project DiSH (Diabetes, Stroke and Hypertension) funded by National Institutes of Health, $750,000, **Co-Prinicipal Investigator.** 2000-2002.

Proposals Submitted

NASA Summer of Innovation in the Nation's Capital; NASA Cooperative Agreement Notification NNH10ZNE004C. (February 2010). Not funded

IES Prospectus: An Examination of Why High School and College Students Major in STEM." (Not accepted).

NASA- Proposal Number 10-GCCE 10-0018 'Exploring the Impact of Climate Change (pending). Amount - $301, 107.

Review Panels

Review grant applications for Comprehensive School Reform Demonstration Grant RFA #0930-04. (January 2005).

Reviewer: Mathematics and Science Partnership Proposal, National Science Foundation, Spring 2003.

Advisory/ Editorial Boards

Mid Atlantic Region Space Science Broker, A NASA Sponsored Program, (March 2004 –February 2005).

Journal of Negro Education, Editorial/Advisory Board Member, 2002-2005.

Mid-Atlantic Eisenhower Consortium at Research for Better Schools, DC Steering Committee.

Journal of the Research Association of Minority Professors (RAMP), Editor, 1989 – 2003. Editor of RAMP newsletter and conference planner.

Journal of College Science Teacher, Reader Focus Group, October, 2003, Arlington, Virginia.

Electronic Science and Literacy Journal, Section Editor, (2002 to present). San Jose State University, San Jose, CA.

Texas Southern University's College of Continuing Education awarded from National Institute on Disability and Rehabilitation Research (NIDRR). Center for Minority Training and Capacity Building for Disability Research, (2001-2003)

Recognition

Faculty Author Certificate in Recognition of Work Published during 2009-10.

Larry King Live. (April 13, 2010). Guest of Dr. Bill Cosby. Topic: Bullying.

Distinguished Alumni Award. (October 2008) Texas Southern University.

Frank T. Hawkins Distinguished Award, 2008, Research Association of Minority Professors, Houston, TX.

Quest: Research at Howard University, Fiscal Year 2003: Top Recipients of Extramural Funds by Broad Disciplinary Categories. Arts, Humanities and Social Sciences: Irving, Marilyn M. Curriculum and Teaching, $488,116, p. 16.

Point of Excellence Award: For Distinguished Contributions to the Field of Education. Kappa Delta Pi: International Honor Society in Education. (February 2004). Howard University, Washington, D.C.

Faculty Service Award. National NASA/NSU Pre-Service Teacher Conference: Inspiring the next generation of explorers. (February 2004). Alexandria, VA.

Exemplar in the Field of Education, Howard University Magazine, A faculty of distinction: Howard professors continue to shape the next generation of leadership. (Spring 2003), p.40.

Professional Award. (2003). The Business and Professional Women League, Inc., Washington, D.C.

Distinguished Faculty Author for Scholarly Work Published during 2001-2002. (April 2002). Howard University, Washington, D.C.

Task Force

Howard University Charter School – wrote the science curriculum.

Presentation at Workshops

Conference and Workshop Presentations

Irving, M. (February 2008). Ready to teach and science and mathematics for all. Research Association of Minority Professors conference, Houston, TX.

Dickson, L., and Irving, M. (February 2005). Teaching methodologies. Learning Communities for STEM Student Achievement, Howard University Graduate School.

Irving, M. (September 27-29, 2004). Faces of a healthy future: National conference to end health disparities. The School of Health Sciences, Winston-Salem State University. (Poster/Learning Center Display)

Irving, M. (April 2004). Teaching methodologies. Naval Postgraduate Dental School. Bethesda, MD.

Irving, M., Austin, W.L., Dickson, L. and Dantley, S. (January 2004). Evolution of science: Research, Curricular Reform and Policy Implications. Research Association of Minority Professors' Conference, Houston, Texas.

Irving, M. (November 2003). Secondary Science Teachers Monthly Meeting. District of Columbia Public Schools.

Irving, M. (March 2003). Inquiry-Based Science Lessons: Turning Students into Scientists. National Science Teachers Association, Philadelphia, Pennsylvania.

Irving, M., and Austin, W.L. (February 2003. Project DiSH: Diabetes, Stroke and Hypertension. National Institutes of Health, Science Education Partnership Association, San Diego, CA.

Irving, M. (2000 -2004). Developing teacher leaders at the middle and high school grades. National Science Foundation Grant.

U.S. Secretary of Education, Dr. Richard Riley, Satellite Town Meeting, " Multiplying Excellence: Ensuring Quality Mathematics and Science Teaching," Howard University, (April 2000).

Transportation, distribution and logistics building linkages project. Advisory Consortium Meeting. Advisory Board, U.S. Department of Transportation, Garrett A. Morgan: Technology and Transportation Futures Program (recommended by U.S. Dept. of Transportation Secretary, Rodney Slater. Washington, D.C. April 26, 2000.

Irving, M. (February 2000). Implementing engineering design activities. Research Association of Minority Professors Conference, Houston, TX.

National Conference on Teacher Quality sponsored by U.S. Department of Education; group members, Dr. Rosalie Boone – Howard University and Mrs. Carolyn Kornegay - DCPS Washington, D.C. January 9, 2000.

Quality Education for Minorities (QEM) Network, participant in a workshop on "Scholarly Productivity" conducted by QEM and National Association for Equal Opportunity in Higher Education (NAFEO) (November 1999), Durham, North Carolina.

Irving, M. & Hunter, E. (1999, June and November). *Integrating Mathematics, Science and Language Arts across the Curriculum*: Middle School Teachers, District of Columbia Public Schools. Theme: Flight. School of Engineering, Howard University.

Irving, M. (1999, May). Implementing design-engineering activities. Howard University, School of Engineering.

Irving, M. (1999, March, April, May, June, September, October). Developing teacher leaders at the middle and high school grades. National Science Foundation Planning Grant.

Irving, M. (Spring 1999). Integrating content and pedagogy. Centers of Excellence, Research, Teaching and Learning (CERTL). *Current Issues in Biology.*

Irving, M. and Boone, R. (1999, February). "Guidelines for publishing in the *Journal of the Research Association of Minority Professors,* Research Association of Minority Professors Conference, Washington, DC.

Irving, M. (1999, January). Assessing quality work. District of Columbia Public Schools conducted for middle and secondary teachers.

Irving, M. (1998, October). Follow-up Workshop: *Integrating Mathematics, Science and Language Arts across the Curriculum.* School of Engineering, Howard University.

Irving, M. (1998, September). *Maintaining and Operating Black Student Unions.* University of Wisconsin-Whitewater.

Irving, M. (1998, August). Engineering Coalition of Schools for Excellence in Leadership (ECSEL). School of Engineering, Howard University.

Irving, M. (1998, April). *Music: Body Movement.* Early Childhood Conference, University of Wisconsin-Whitewater.

Irving, M. (February 1998). *Analysis of Professional Development Models in Mathematics, Science and Technology in an Urban School District.* Research Association of Minority Professors Conference, St. Louis, MO.

_______ (1997, November). *Strategies and Techniques for Improving Student Achievement in Mathematics and Reading.* San Francisco Unified Public Schools, San Francisco, CA.

_______(1997, November). *Flying High with Mathematics and Science.* Urban Systemic Initiative, Milwaukee, WI.

________(1995, April). *Systemic Reform in Mathematics and Science in the Southwest Region.* Science Leadership Conference Network, Lafayette, LA.

________(1995, April). *Let's Catch the Culprit.* Science Leadership Conference Network, Lafayette, LA.

________ (1994, November). *Science and Mathematics for All.* National Alliance of Black School Educators, Los Angeles, CA.

_______ (1994, October). *Systemic Reform.* Louisiana Mathematics and Science Conference, Alexandria, LA.

_______ (1994, January). *Restructuring Science Education.* Association of Educators of Teachers of Science, El Paso, TX.

_______ (1993, October). *Providing Resources to Support Systemic Change.* Louisiana Mathematics and Science Conference, Alexandria, LA.

_______ (1993, October). *Approaches to Integrated Teaching: Implications for Math and Science Teaching.* Louisiana Mathematics and Science Conference, Alexandria, LA.

Boorman, J.; Irving, M.; Keig, P.; Parsons, S.; Robertson, H.; Shaka, F.; and Slinger, L. (1993, April). *Culturally Responsive Science in Elementary Schools.* National Science Teachers Association Annual Convention, Kansas City, MO.

Dwight D. Eisenhower Science and Mathematics Program (1993, January). Facilitator for workshop on assessment, Austin, Texas.

Undergraduate Teaching Improvement Council Conference. (April 1992). *Engaging the Inquiring Mind Approaches to Learning in Mathematics and Science.* University of Wisconsin-Parkside, Kenosha, Wisconsin.

Science Education Service Center Network Advisory Council. (1992, January). Assisted in collaborating to strengthen the elementary science method course in the Wisconsin higher education system. Madison, Wisconsin.

Tenth Annual Conference. Research Association of Minority Professors. Houston, Texas. (February 7-9, 1991). President.

Irving, M. and Pulliam, R. Conflict Resolution through Peer Mediation. Beginning Teachers' Mentoring Program. University of Wisconsin-Whitewater. December 11, 1990.

Irving, M. (1990, November). *The Special Needs Child in the Science Classroom.* University of Wisconsin-Whitewater, Whitewater, WI.

_______ (1990). *Science is Fun Workshop.* Caddo Parish Schools, Shreveport, Louisiana; Milwaukee Public Schools; Ouachita Parish Public Schools, Monroe, LA.

Irving, M. and Olson, A. (1989, October). *Mystery Powders: Utilizing the Process Skills.* National Science Convention, Milwaukee, WI.

Women and Minorities in Science and Mathematics: Establishing Linkages for Success. (1989, September). Milwaukee, WI.

Irving, M. (1989, February). *The Plight of Black Teachers.* Research Association of Minority Professors, Houston, Texas.

Presentation at Conferences and Professional Meetings

Other Professional Development Activities and Workshops
Professional Development/Attendance at Professional Meetings
Professional Development: National Biodiversity Institute. (July 1999). Disney World, Orlando, Florida. Selected by the District of Columbia Public Schools to be the university faculty on the team with teachers selected from the District. The purpose of the Institute was to collaborate with several teams both national and international to design a plan to infuse in the District's existing curriculum to find ways to help clean the Anacostia River.

Workshop: Engineering Coalition of Schools for Excellence in Leadership (ECSEL), *Design Technology.* (August 1998). Modeled instructional strategies to ten high school teachers in the District of Columbia Public School System to assist them in motivating students to participate in a national competition to solve the problem given by the Junior Engineering Technology Society.

Workshop: Project SCORE: Life Science Summer Institute. (July 1998). *Pedagogy and the Constructivist Approach.* Twenty-five middle school teachers from Prince Georges Public School System participated in the workshop.

Course Workshop: Centers of Excellence, Research, Teaching and Learning (CERTL). (July 1998). *Current Issues in Biology.* Incorporated the constructivist approach. Seventeen middle and high school teachers participated in the workshop.

Workshop: Dwight Eisenhower Mathematics and Science Program. (June 1998). *Institute for Middle Grade Teachers: Integrating Mathematics, Science and Language Arts Across the Curriculum.* Three teachers from six middle schools in the District of Columbia Public Schools and three preservice teachers participated in the workshop.

Professional development workshop: *Integrating Mathematics and Science.* (1997). Katie C. Lewis, Washington, D.C.

Workshop: *Assessment.* (1997). Sixty middle school teachers in the District of Columbia Public School System.

Hands-on: Integration of Science and Mathematics - K - 8. (1996). St. Thomas More Catholic School, Washington, D.C.

Coordinated, trained, monitored and served as the liaison person for the Southwest Consortium for the Improvement of Mathematics and Science Teaching Professional Development Projects: Southwest Educational Development Laboratory, Austin, Texas. Arkansas, Louisiana, New Mexico, Oklahoma, and Texas, January 1993- August 1996.

Service to the Field

Planning Committee Member. Brown @ 50: Where Do We Go From Here? Reflections and Projections. (May 6, 2004). Howard University.

Faculty of record for 136 teachers in the SECME national program, collaboration between the School of Education and the College of Engineering, Architecture and Computer Sciences, and Georgia Institute of Technology, Atlanta, GA. Partnership with teachers. (Summer 2003).

Conference chair, Research Association of Minority Professors, Washington, D.C., (February 2003).

Director of the Advanced Placement Institute (Summer 2001 and 2002). Howard University, offered Biology and English Literature.

Faculty Marshall (2001,2002), Howard University Commencement Convocation.

Retention Sub-Committee, review of policies and procedures for Articulation and Retention (2002). Office of the Provost, Howard University.

Eisenhower Southwest Consortium for the Improvement of Mathematics and Science Teaching, participate in the discussion on "Diversifying the Science and Mathematics Teaching Work Force (April 2000)

"Mathematics and Science Education Beyond 2000," The sessions explored the relationship between teachers' understanding of content and the quality of their instruction, etc. (September 2000)

SECME/Howard University served as the School of Education's consultant to the CEACS in designing the institute's curriculum and evaluation, (1999).

University Service - Howard University

Department Curriculum Committee - (1998 - present), chairperson 1998-2000
School of Education - Curriculum Committee (1998 - present) chairperson 2000- 2001
Evaluation Committee - (1997-98)
Nominating Committee (School) - (1997- 2001).
Executive Committee (School) - (1998 - 2001)
Recruitment and Retention Committee - (1998-1999)
Center for Urban Progress - (SEEDCO project)
Center for Research on Educating Students Placed At-Risk (CRESPAR) – (1996-1999) Assessment Team
Faculty Senate Library System, and Resources Committee (University) - (1999-2001)
Community Development Curriculum (University) - (1997- 2001)
Centers for Research, Education and Science Teaching (CREST) (University) (1999-2001)
NASA Collaboration (University) (1999-2004)

Membership and Professional Societies

Association Supervision and Curriculum Development - current
National Science Teachers Association (1988 -present)
Research Association of Minority Professors (1982- present)
Council of Elementary Science International (1994- present)
Association of Educators of Teachers of Science (1994 - present)
National Council of Teachers of Mathematics (1998 - 2000)
National Alliance of Black School Educators (NABSE) (1988 - 2000)
Alliance of Multicultural Science Education (AMSE) (1993 - present)
Organization of Blacks in Science (OBIS) (1998 - present)
Minority Women in Science (MWIS) (1998 - present)

National Organizations

Morgan Garrett - U.S. Department of Transportation (1997-2000)

World Wildlife Fund, National Biodiversity Education Leadership Institute – Disneyworld (1998), Faculty of record for the team of teachers from the District of Columbia Public Schools, created an action plan for DCPS teachers, Orlando, FL (1998 – 2003)

Major Professional Service

Science Discovery Day for Middle School Students. (March 6, 2010). More than 70 middle school students and their parents participated.

Judged Science Fair Projects for local elementary and high schools and citywide in the District of Columbia, (1999 to present).

Project Kaleidoscope: Provide pre-service teachers the opportunity to conduct hands-on science activities in chemistry to elementary students from the District of Columbia Public Schools at the National Building Museum at the national conference; open forum for over 600 participants from the national science community; other Howard University faculty – Dr. Leon Dickson, Jr. and Dr.Valarie Lawson (October 1999)

Keynote speaker at Brookland Elementary School for Science Fair Awards Day (May 1999)

Recipient of an award from Raymond Elementary School for establishing a partnership with the Even Start Family Literacy program.

Review and evaluated secondary science textbooks for the District of Columbia (1999).

Serve on the advisory committee for Hands-on Science Outreach (HOSO) recommended by Slyvia T. Johnson (1997-98).

Reviewed unsolicited proposal for the Directorate of Education and Human Resource, National Science Foundation, (February 1998).

Served on Reverse On-Site Review Panel for the Division of Undergraduate Education, National Science Foundation, led and prepared a summary, (April 1998).

Participated in the National Science Foundation Public Forum concerning Student Scientist Partnerships to foster collaboration between science and education, October 1996.

Reviewed and selected instructional materials for inclusion in the National Science Resources Center's (NSRC) annotated guide for middle school programs, *Resources for Teaching Middle School Science* with approximately 40 scientists and engineers, September 1996.

Consultant for the Medical and Science Summer Program at the University of Wisconsin-Whitewater. (1989 to present)

Consultant for Postgraduate Dental Naval Academy, Bethesda, MD. (2002 to present)

Consultant for Howard University's School of Engineering ECSEL Program working with teachers to increase their skills in teaching problem-solving skills to students. (1997-2000). Junior Engineering Technical Society (JETS) National Engineering Design Challenge (2000) Served as one of the panelist of judges
Design activities for local teachers and community leaders, developed a trainer of trainer model for local teachers and community leaders to use activities in their programs and projects. JETS is a national, not for profit education organization that promotes interest in engineering, science, mathematics and technology, JETS' programs emphasize aptitude and learning experiences, higher-order thinking skills, creative thinking and ingenuity, team work, effective communications, academic rigor and leadership skills.

Education Coordinator for the Center of Excellence, Research, Teaching and Learning Program funded by the National Science Foundation. The program was designed to assist teachers who are teaching advanced placement biology, chemistry, and physics courses to improve their teaching methods to help encourage more minority students to enroll in these courses. (1997-2000) Comprehensive Partnerships for Mathematics and Science Achievement/Urban Systemic Program funded by the National Science Foundation. Collaborative effort (Drs. Orlando Taylor, Leon Dickson, Biology, Charles Hosten, Chemistry, Raymond Butcher, Chemistry, Eric Walters, College of Medicine and Anna Coble, Physics.

Assessment team member on the project "Broadening the Scope of Assessment in the Schools," (Slyvia T. Johnson, Gerunda Hughes, Shelia Thompson, Michael Wallace) which is one of the programs under the Center for Research of Educating Students Placed At-Risk (CRESPAR). Actively participated in the planning and development of research activities. Conducted a one day long professional development workshop for 75 middle school mathematics and science teachers in the District of Columbia Public Schools at Backus Middle School (1997-99)

Consultant for Alice Ferguson Foundation, Inc. - Environmental Education on the Potomac, focus on curriculum development and constructivist lessons, collaborative effort with the Potomac area, national parks and Howard University faculty members in the Department of Biology (1997-98)

Served as a member of the national Program to Improve Methods Courses in Elementary Science (PIMCES), funded by the National Science Foundation for elementary science professors from across the nation. (Summer 1992)

Served as consultant with others from the American Academy for the Advancement of Science (AAAS) to conduct a Principal Leadership Academy in Dallas, Texas. One of the main purposes of the Academy was to provide the principals and their teams of

"Integration of Mathematics and Science Teaching at the Elementary Grade Level."

Dwight D. Eisenhower Science and Mathematics Program Funds - 1997 - $43,000, **Co-PI**" Summer Institute for Middle Grades Teachers: Integration of Mathematics, Science and Language Arts."

Howard University Faculty Research Grant - 1996 - $9000 - **PI**
Survey: Analysis of Effective Professional Development Models in Mathematics, Science and Technology of Elementary School Teachers in the District of Columbia.

Selected Publications

Dr. Marilyn Irving

MEETING THE NEEDS OF THE SPECIAL LEARNER IN SCIENCE

Marilyn M. Irving,
Mildred Nti,
Wilfred Johnson
Howard University

One-hundred-and-twenty secondary science teachers responded to a survey entitled Teaching Science to Students with Special Needs in Inclusive Settings *to assess their knowledge and preparation in working with students with special needs in the science classroom. The authors focused on the following questions (1) How can a secondary science teacher with no training in the area of students with needs adjust his/her teaching strategies? (2) What resources can the secondary science teacher utilize to teach students with special needs? And (3) What does the secondary science teacher need to do, to better meet the needs of special learners? The authors discuss methodologies that can be used to assist science teachers in effectively teaching students with special needs. The researchers propose effective practices to help teachers to help students with special needs achieve and become interested in science. A qualitative and quantitative research design was used to analyze the data. Results of the survey revealed that, one hundred percent (120) of the teachers surveyed needed support on various instructional methodologies to be more effective in teaching science to special learners.*

According to various organizations and mandates such as Public Law (PL) 94-1427 (1975), special education and scientific investigation have become inextricably connected over recent years. PL 94-1427 is an act that states that all individuals with a handicap should be offered a *free appropriate public education which emphasizes special education and related services designed to meet their unique needs, to assure that the rights of handicapped children and their parents or guardians are protected, to assist states and localities to provide for the education of all handicapped children and to assess and assure the effectiveness of efforts to educate handicapped children.* (http://asclepius.com/angel/special.html, 2006).

Although the growing importance of science education for students with disabilities has been recognized, research by Patton, Polloway, and Cronin (1990) indicated that many students with disabilities receive very little or no science instruction. Because many special and general educators have not been adequately prepared to teach science to students with disabilities (Gurganus et al., 1995), they often either use a content-oriented approach that focuses on learning vocabulary or factual text-based information through textbooks and teacher-directed presentations such as lectures and demonstrations (Mastropieri & Scruggs, 1994; Weiss, 1993). This approach requires students to have certain levels of reading, writing, and memory skills; thus, many students with disabilities do not benefit from this approach (Mastropieri & Scruggs, 1993). They therefore often receive low grades and perform significantly below their general education peers (Holahan, McFarland, & Piccillo, 1994; Parmer and Cawley, 1993). Students with disabilities, however, can learn and master content in the general education curriculum when teachers employ instructional adaptations based on certain kinds of effective practices (Grossen & Carnine, 1996; Scruggs & Mastropieri, 1993). Successful science teaching approaches include tutoring, cooperative learning, mnemonic strategies, and self monitoring strategies (Mastropieri and Scruggs, 1995).

Many of the students who have not become part of the current science education reform movement are poor, students of color, or students with disabilities. Others are English speakers of other languages (ESOL) (Minicucci et al., 1995) and yet others may demonstrate social-personal, and intellectual disabilities. Students with disabilities are often homogenously grouped in self-contained classrooms where they have little interaction with other students in the school and are excluded from science education reform.

Students should have the most competent teachers with an in-depth understanding of the subject matter to ensure that grade level standards are met. These requirements apply whether the teacher provides core academic instruction in a regular classroom, a resource room or another setting. General education and special education teachers need to be knowledgeable and skilled in how to teach all students, including students with special needs, so that all students can achieve to high academic standards.

The *No Child Left Behind* (N.C.L.B.) Act strongly affirms that all students including those with disabilities can achieve high standards. N.C.L.B. works in conjunction with the Individual's with Disabilities Education Act of 1997 (IDEA), which is the nation's special education law. Under this law, students with disabilities must have access to the same good high-quality curriculum and instruction as all students.

Schumm, Vaughn, Gordon, and Rothlein (1994) suggest that teachers are not likely to change their teaching behavior unless they are given the skills, knowledge, and confidence to do so. When new contents or new skills are presented over a series of training sessions that include a limited amount of information, followed by opportunities for classroom practices with coaching, changes in teaching become evident (Guskey, 1986; Joyce & Showers, 1983; Joyce & Showers, 1988; Sparks, 1983).

Special education is more demanding than mainstream education as confirmed in the literature. Wolfendale (1992) emphasizes that the skills and expertise needed for special needs teaching are clearly different from the teaching skills required for mainstream learners. Bos and Vaughn (1994) therefore contend that teachers need special training for students with special needs.

Problem

Many teachers who teach science lack the training and resources to adequately teach students with special needs. Since the majority of students with special needs receive their science education in general education classrooms, it is incumbent upon the special educator to implement and validate curriculum and instructional support systems which aid the students in becoming competent and knowledgeable of the processes, concepts, and principles of science. Participants from the *Developing Teacher Leaders in Middle and High School Science,* who responded to the *Teaching Science to Students with Special Needs in Inclusive Settings* recognized that students with special needs must meet the same high standards as all students in the classroom. They believe that *watering down of the curriculum* is a disservice to all. With the push for placing special needs students in inclusive classrooms, science teachers must be provided with continuous training to effectively teach students with diverse learning styles.

Purpose

This article will focus on the working with students with special needs in the secondary science classroom. The overall goal of the *Developing Teacher Leaders in Middle and High School Science (DTL's)* Project was to help science teachers increase their content knowledge and upgrade pedagogical skills in secondary science.

The DTL project included three approaches: 1) interactive lectures and laboratories, 2) alternative teaching and assessment strategies, and 3) teaching activities which were consistent with national and local standards. Workshops were held on a variety of topics designed to support the pedagogical growth of participants. For instance, the session on *students with special needs* addressed ways and methods for working with special-needs children in the regular classroom.

Research Design:

The research design is both quantitative and qualitative. A pre-and-post test was administered to the secondary science teacher participants to assess their experience in teaching students with special needs.

Method

One hundred and twenty one secondary school (middle and high) science teachers from the Washington, DC metropolitan area who also participated in the professional development project funded by the National Science Foundation. Surveys were administered to participants at the beginning of pedagogical sessions to assess their prior knowledge of and/or familiarity with specific topics. For example, participants were given a pre-assessment survey to determine the extent of their prior knowledge of working with special needs students.

Each teacher received approximately 50 hours of professional development training with six hours geared toward working with diverse learners. During the professional development sessions, teachers received direct, hands-on instruction and retraining in the fields of special education. The sessions were conducted by university professors from their area (special education, reading biology etc.) of expertise. The sessions *meeting the need of the special learner* focused on pedagogical skills. Many of the concepts examined during the sessions included specific topics of interest identified were indicated by participants who completed a pre-assessment survey. Teachers who participated in the session had the opportunity to:

1. Gain new information on current issues in the area of teaching students with special needs
2. Experience hands-on activities related to fostering students interest in the content area
3. Share ideas and activities with other teachers, and
4. Adapt new information to their curriculum so that it could be used in their specific classroom environment.

Teachers were assisted to design activities especially for special need learners. *Science Activities for the Visually Impaired* and *Science Enrichment for Learning with Physical Handicaps*, both developed at Lawrence Hall of Science at the Berkeley campus of the University of California (http://www.His.Berkely.edu) were introduced to them.

The project enhanced instructional practices that were grounded in the constructivist approach. The focus was on hands-on activities and pedagogical approaches in increasing skills in various content areas. Teachers were encouraged to adopt alternative methods of instruction and to rely less on traditional methods, such as requiring students to work individually and participate in classroom discussions led by the teacher followed by rote question and answer sessions. Participants were thereby encouraged to integrate the *5E's (Bybee, 2005) approach (Appendix A)* (engage, explore, elaborate, explain, and evaluate) into their daily teaching by modeling the theory of constructivism in the classroom and through shared lesson planning. The 5 E's model utilizes an inquiry-based approach that provides students with concrete learning experiences and a starting point from which to construct science concepts. In this model, learning is viewed as an active rather than a passive process. Teachers were encouraged to become facilitators of learning in order to help students acquire knowledge that is meaningful to their lives.

After the professional development intervention, participants responded to a survey entitled *Teaching Science to Students with Special Needs in Inclusive Settings* (Appendix B) to assess their knowledge and preparation for working with special learners. Assessments were performed by the project staff and external evaluators through observations of participants in various individual and group learning activities to test their delivery of content, and comprehension.

After participating in the long term (50 contact hours) professional development teachers were observed in their classrooms. Seventy-six (76) classroom observations data revealed that a majority of the teachers demonstrated varying degrees of the constructivist approach in their teaching practices. Particularly, most teachers presented a lesson using the 5E's method. Teachers initially began each class period by engaging students in warm-up activities that ranged from mini-lab experiments, to defining vocabulary words, to watching a video about basketball to learning the concepts of bar and line graphs which included all students with different learning abilities.

Technology was integrated into many lessons, with the teacher using overhead projectors, requiring students to use the internet to research assigned topics or to complete in-class assignments. One classroom teacher supplied calculators to each group of students to complete an in-class assignment. Individual seatwork was rarely observed in the classrooms. Collaborative group work and team work were the preferred methods employed by the teachers, especially at the middle and junior high school level. When working with mixed-ability groups with students with special needs, students were often assigned a role, such as recorder, researcher, and equipment operator. In a sixth-grade classroom, the lesson for the day was to design a scale model of the solar system using paper towels, magic markers, tape, a data sheet for scale calculations, and a ruler. The teacher began the lesson by asking students to recall what they knew about the solar system. Students eagerly raised their hands to share their prior knowledge. Students were then divided into groups of 5 and each group completed the same assignment. The students were permitted to work in the hallway outside of the classroom, and each student in the group was assigned a role. The students were actively engaged in the learning process throughout the entire observation period, and they worked collaboratively for 90% of the observed time.

In one ninth-grade science class that comprised students receiving special education services and those receiving regular education services, the teacher wrote the objectives of the lesson on the blackboard, as well as the warm-up activity, and the assignment due for the week. The teacher began the lesson on water pollution by allowing each student to select a small labeled canister. As the teacher read *The Pollution Story,* each student walked to the front of the classroom when his or her material was called and dumped the contents of the canister into the fish bowl. The fish bowl was filled with fresh, clean, water prior to the beginning of the lesson. As more and more elements were added to the water the students saw first-hand how the water became polluted from various materials and elements. The students were actively engaged in the activity. Following the story, the teacher presented five questions on the overhead projector, which students were instructed to answer in their journals. The questions were related to the pollution activity, and included questions such as: a) who polluted the river, b) what could have been done to stop it, c) how can they clean the river of pollutants, d) is it easier to clean the river or to prevent pollution, and e) what could you start doing today/right away to help improve the water shed where you live? All students were actively involved in the activity.

Results

The results of the survey (see Appendix B) developed and administered by the Howard University project staff indicated that a majority of participants improved their content knowledge after participating in the advanced training. Sixty per cent of the participants taught in a Junior High/Middle School and 40% taught at the high school level (See Figure 1) of which 65.8% were female teachers and 34.2% were male (See Figure 2). The participants represented diverse ethnic groups (See Figure 3). A significant number (26.6%) of the participants had 20 or more years of teaching experience (See Figure 4); 45.1% had obtained a Bachelor's level education and 33.1% of the participants had a master's degree (See Figure 5). Approximately 95 per cent of the teachers were certified including provisional and temporary certification (See Figure 6).

Figure 1
Participating Schools

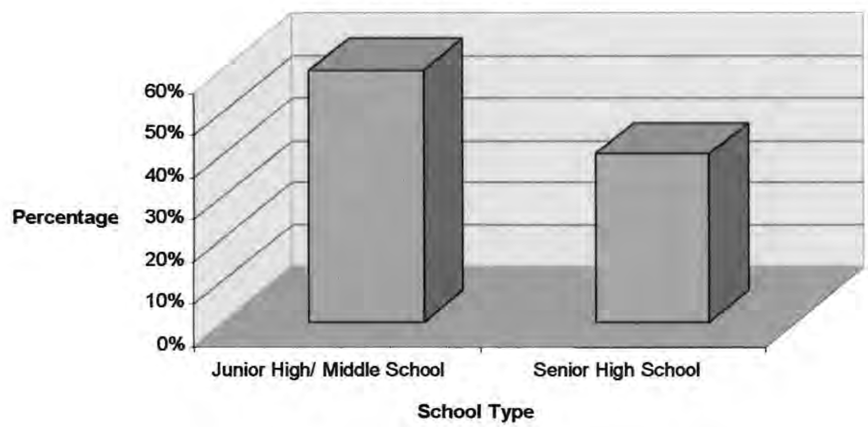


Figure 2
Gender of Respondents

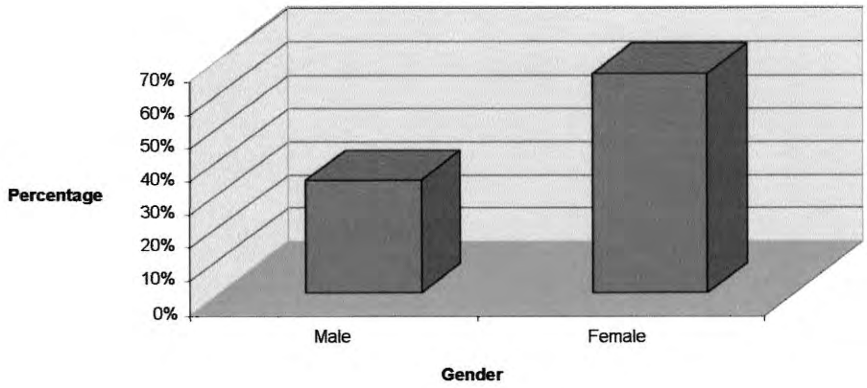


Figure 3
Ethnicity of Respondents

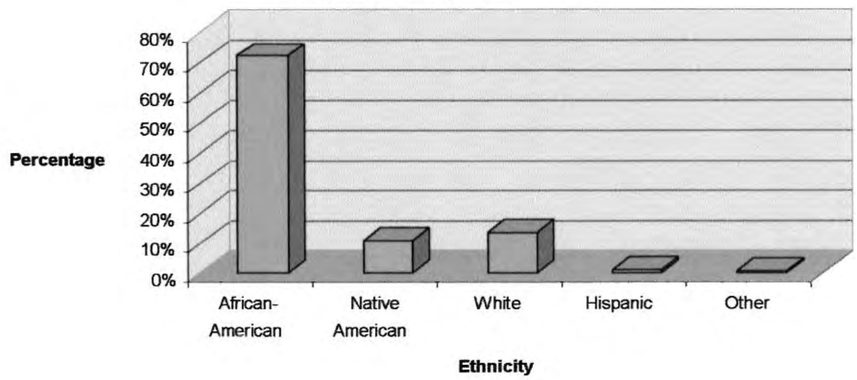


Figure 4
Respondents Years of Experience

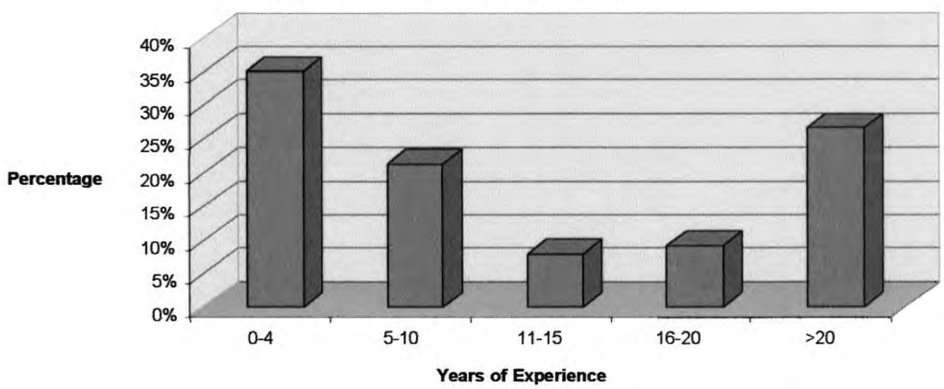


Figure 5
Degrees Held by Respondents

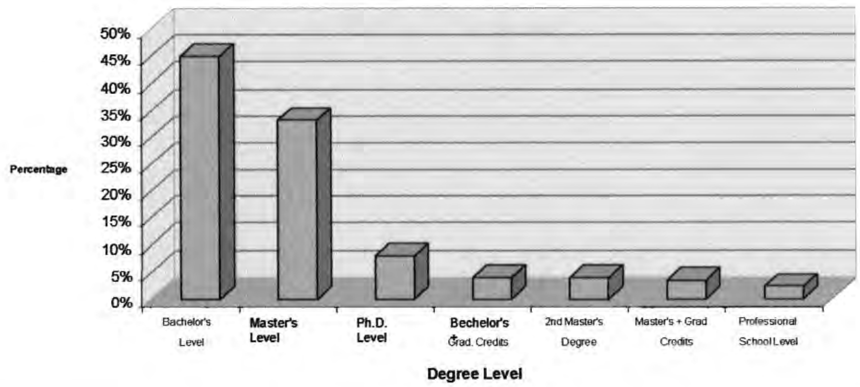
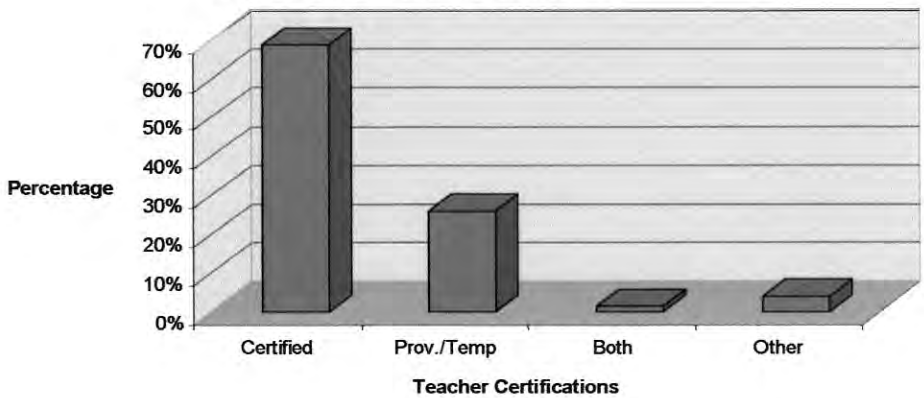


Figure 6
Distribution of Teacher Certifications



Responses from the following questions were analyzed:

In which specialty area were you trained as a teacher?
One hundred per cent of the teachers revealed that they had not been trained in special education.

Have special/inclusive students been identified in your class (es)?
One hundred per cent of the teachers indicated that they students with special needs were placed in their regular science classes.

If you teach included students, what do you need as support in order to a better job of teaching?
The ninety two per cent of the teachers expressed the need for more professional development to increase the skills needed to teach students with special needs. They also indicated the need for special training to teach students with special needs. The teachers also indicated that they had various groups of students by ability in the mainstream classroom, and requested suggestions and ideas for appropriate teaching styles for special needs inclusive students. They stated that short attention span or lack of understanding of special needs students contributed to behavioral challenges. The teachers stressed that two or more students with special needs who are placed in their classroom require them to have additional responsibilities and more work. Teachers ascertained that they had to plan and adapt activities and materials to ensure the participation of some learners with special needs. They expressed that they needed modification materials, and would appreciate resources such as classroom aides or assistants to assist them in the implementation of lesson plans and classroom activities/curriculum.

Have you had any staff development, relative to included students?
Of the 120 teachers who participated in the project, 18 reportedly received staff development training related to students with special needs. Some of the teachers had no prior background experience teaching science to students with special needs.

Would you like to have more information regarding included students?
All 120 teachers responded *yes* that they would like to have additional information on teaching strategies, effective resources, and materials that can be used to successfully teach students with special needs. Resources and materials used by the teachers of special learners can have a great impact on what and how information and skills are taught.

Discussion
Teachers were encouraged to familiarize themselves with what are the special needs of the learner, adapt and modify materials and procedures to meet the needs of the special learner. In regards to content, teachers were encouraged to incorporate activities into lesson that engage all learning modalities-visual, auditory, tactile, and kinesthetic. Observations of an English Language Learner (ELL) science classroom revealed that the 5E's format was adapted to meet the needs of all developmental/educational levels enrolled in the class. The lesson on the solar system was presented with confidence and enthusiasm. The teacher used hands-on demonstrations and visuals to explain concepts. Student-centered discussions were the preferred method employed by the teacher, and the lesson began by asking students the question, *What is the solar system?*

The teachers interviewed reported that they used more technology in class, and had begun to do more journaling with their students as a result of participating in the project. Several teachers also described the special education strategies as being extremely helpful and useful. Interview and observation data also revealed that the participants attempted to integrate the new strategies, teaching practices, and content into their class lessons. Inquiry-based activities, collaborative group work, student-centered discussions, and hands-on labs were just a few of the common practices observed in classrooms throughout the years when teachers worked with students with diverse learning abilities.

The use of the 5E's method, the integration of technology, journaling, and the ways of including and addressing special needs in the classroom were by far the most talked about strategies and tools among all interviewees. It was also noted that students with cognitive challenges may benefit more from the use of concrete materials in learning as opposed to more of a content oriented instruction approach. The researchers assert that all students will demonstrate an affinity for science when an active teaching method is used as opposed to a passive one. This approach to teaching will have more of an impact with students who will be able to relate the teaching content with daily life experiences.

As a result of the professional development project, teachers incorporated the following instructional that helped them to meet the needs of diverse learners:

1. Established multiple learning centers within the classroom.
2. Integrating learning with student's prior knowledge
3. Provided a structured learning environment with consistent and lucid procedures.
4. Provided ongoing and frequent monitoring of individual student learning (formative assessment).
5. Implemented interactive computer programs and multimedia tools.
6. Used small-group and cooperative learning strategies.

Conclusion
The role of research in special education for students with diverse learning styles has been particularly significant. Providing appropriate special education and related services, i.e. aids and supports in the regular classroom to teachers is very important. School districts should provide support and high quality intensive professional development for all personnel who work with students with special needs in order to ensure that they have the necessary skills and knowledge that will enable them to meet the needs of the diverse learners. All students find science exciting and relevant when it is taught as an active rather that is a passive process. When students can relate what they are learning to their everyday lives, they feel a sense of ownership to the subject. As science teachers, it is important to consider and be aware of the needs of individual students. These diverse needs should be reflected in the curriculum. The science teacher of special needs learners must do much more that simply follow a fixed and

prescribed curriculum, because the science teacher constantly has to adapt to the specific and unique special needs of the learner.

Recommendations

In order to have a solid curriculum for effective teaching and learning, the authors propose that all science teachers should incorporate the following in their approach to teaching:

1. Hands-on laboratory experiments
2. Cooperative learning activities such as Think, Pair, Share
3. Use of multimedia tools
4. Small group activities
5. Participant presentations
6. Demonstrations
7. Projects structured around a problem
8. Hands on learning activities using instructional materials.
9. One-minute reading comprehension

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Appendix A
5 E's Instructional Model

Engagement Phase:

The purpose of this phase is to develop an activity or activities that make a connection between prior knowledge and the new learning experience. This phase should include activities that:	
•	Captivates the student's interest (examples: scenario, problem, news articles, etc.
•	Stimulates critical thinking.
•	Connects prior knowledge with new concepts.
•	Relates to real-world experiences.
Some examples of teaching strategies for the engagement phase include:	
•	Demonstrations
•	Discussion of newspaper/magazine article
•	Role playing

Exploration Phase:

The purpose of this phase is to provide students with hands-on minds-on experiences that enable them to identify, explore, or develop concepts, processes, and skills. During this phase students can investigate a problem, make observations, and organize collected data.	
Some examples of teaching strategies for the exploration phase include:	
•	Laboratory experience
•	Problem-solving activity
•	Computer search
•	Scenarios or role-play that encourage students (in small groups) to discuss a real-world problem, to purpose a hypothesis for solving the problem, and to justify (based on an investigation) the rational for their hypothesis.

Explanation:

This phase encourages students to interpret and statistically analyze data from their explorations, develop explanations, and refine or adjust previously formed concepts. During this phase the teacher can introduce new vocabulary and define and clarify new concepts, skills and processes.	
Some examples of teaching strategies for the explanation phase include:	
•	Constructing/interpreting graphs
•	Graphic organizers
•	Guided reading activity
•	Mini-lecture
•	Guided discussion
•	Computer assisted instruction
•	Video

Elaboration:

The purpose of this phase is to extend student learning and to challenge students to understand and construct new knowledge. During this phase students can apply new concepts, processes, and skills.	
Some examples of teaching strategies for the elaboration phase include:	
•	Teacher-directed student discussion
•	Laboratory experience
•	Problem-solving activity
•	Research project – Communicate orally or in writing
•	Production of a product or model

Adapted from 5 'E Instructional Model
http://www.miamisci.org/ph/lpintro5e.html

Appendix B

Survey: Teaching Science to Students with Special Needs in Inclusive Settings			
Please respond to the following questions or statements. Circle the answer where applicable.			
		Yes	No
1	Were you initially trained as a teacher?		
2	In which specialty area were you trained as a teacher? ____		
3	How many years have you taught as a teacher? ____		
4	Have special/inclusive students been identified in your class (es)?		
5	If you taught included students, have you ever read their IEP's?		
6	If you were not initially trained as a special education teacher, what was your area of training? ____		
7	Which content area do you currently teach? ____		
8	If you have taught included students, did you get the human support you needed?		
9	Did a delegate represent you during the development of the IEP's or during the placement process?		
10	If you teach included students, should they be in your regular classes?		
11	If you teach included students, what do you need as support in order to do a better job of teaching? Human Resources Other Resources ____________ ____________ ____________ ____________ ____________ ____________		
12	Does it appear that you have more than your share of included students?		
13	How many years have you taught included students? ____		
14	Do you spend more time on issues to accommodate included students?		
15	Do you think you have lowered the intensity of your class (es)?		
16	Have you had any staff development, relative to included students?		
17	Would you like to have more information regarding included students?		

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Implementing Technology in Secondary Science and Mathematics Classrooms: Is the Implementation Process the Same for Both Disciplines?

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The mathematics and science education communities are presently—and perhaps constantly—in a state of reform. The mathematics and science standards documents now include the use of technology as a common instructional goal. This article synthesizes the findings from two studies, a qualitative study on implementation concerns of secondary science teachers resulting from the use telecommunications and a quantitative study on technology implementation concerns of middle and secondary mathematics teachers and potential teachers of first-year algebra in North Carolina to determine if teachers in both disciplines have similar concerns when implementing technology in the classroom. Both studies used the Concerns Based Adoption Model (CBAM) to assess teacher concerns and levels of technology implementation. Both disciplines were found to have common technology concerns and implementation issues. Several significant differences also were found. Implications for technology-based staff development are noted.

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An Internet Survey: Assessing the Extent Middle/High School Teachers Use the Internet to Enhance Science Teaching

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The purpose of this study was to assess the extent Middle/High School teachers who participated in professional development courses in science used the Internet to enhance science instruction. Surveys were mailed to 53 middle and secondary teachers who had completed two or more professional development courses in biology, chemistry, and physics. Thirty-one of the teachers returned the survey. The survey assessed the extent of teachers' use of the Internet in their classrooms and assessed how frequently they were using it as an instructional tool and for what purposes. Data were gathered from a 20-item survey that consisted of both selected and open-ended responses. Analysis of the data revealed that encouraging teachers to use the Internet enhanced their teaching methods.

As we enter the 21st century, educators agree that all teachers will be faced with the challenge of knowing how to use computers. Not all agree, however, on the definition of computer literacy. The consensus has been that computer literacy requires not only that a teacher must value and be able to use technology but also that he or she feels confident and has the ability to use technology in applying concepts in the classroom.

Today, teachers are expected to use resources acquired from the Internet to help prepare their students for the demands of the 21st Century. The Internet can be a very useful tool for helping students with classroom inquiry and for fostering scientific literacy and natural curiosity of middle and secondary science students. Technological applications have also been found to improve students' motivation to learn and expand their self-confidence (Software Publishers Association, 1996). The Internet provides students with a learning environment that is compatible with the way they prefer to learn (hands-on, visual, and problem solving). Students are increasingly adept and comfortable with computer technology; therefore, it is important that educators become as adept and begin to consider effective ways to capitalize on what we know about students' learning preferences (Owston, 1997). Well-trained teachers are needed who are facile with computers and the use of the Internet. To meet these goals many practicing teachers will have to be retrained, and teacher preparation programs must explicitly include integration of the use of computers as a natural and efficient teaching tool (Friedler, Merin, & Tamir, 1992).

On "NET-DAY 96" the U.S. Secretary of Education made a national issue of teachers' ability to use technology, particularly their ability to access resources on the Internet. On that day Secretary Riley released the nation's long-range plan for educational technology and shared the following goals toward making all schools technology-rich:

- All teachers in the nation will have the training and support they need to help students learn using computers and the information superhighway.
- All teachers and students will have modern multimedia computers in their classrooms.
- Every classroom will be connected on the information superhighway.
- Effective software and online learning resources will be an integral part of every school's curriculum (Riley, 1996).

REVIEW OF LITERATURE

In a recent report, the President's Committee of Advisors on Science and Technology cited possible uses for the Internet in the classroom. According to the report, technology can serve as a potentially powerful tool for teachers, who may use computers and computer networks to: (a) prepare materials for use in the classroom; (b) monitor, guide, and assess the progress of their students; (c) consult with experts in a variety of fields; and (d) exchange ideas, experiences and curricular materials with other teachers (President's Committee of Advisors on Science and Technology (PCAST) Panel on Education, 1997). By using the Internet for curriculum enrichment, teachers can access a multitude of information.

Many public and private programs have been designed to improve science instruction in our nation's schools. These reform efforts include guidelines for what should be taught; new performance-based methods of teaching and assessment; methods of teaching science in an integrated, cooperative hands-on fashion; and publicly and privately supported teacher workshops (American Association for the Advancement of Science, 1993). Concurrently, the amount of science-related information that is available through books (traditional and computer based), computer networks, instructional software, and computer databases has increased dramatically. Even with this increase in resources, science instruction in middle and high school classrooms continues to be in crisis.

Principle tools in addressing this crisis have been summer workshops, evening, and weekend courses. Even though teachers may be enthusiastic about their workshop experiences, the isolation of the individual classroom contributes to continuing problems. When teachers return to their classrooms from workshops, changes in their teaching cannot be easily tracked or supported. Studies have demonstrated that even teachers with the best instructional intentions often fail to use the new ideas and materials in an effective, consistent way that results in greater student learning (Orlich, Remaley, Facemyer, Logan, & Cao, 1993).

Although the use of the Internet is commonplace today, some teachers still do not benefit greatly from it because they do not know its capability and content. Data from the survey of the selected middle and high school teachers can provide insight into the benefits of the Internet to improve instruction.

Despite the development of computer programs and recommendations for the incorporation of technology into the curriculum, much of secondary science instruction is still driven by textbooks and worksheets. This situation is exacerbated by the fact that "...currently schools spend much more on hardware (55%) and software (30%) than they do on training" (Office of Technology Assessment, 1995). Placing computers on school campuses is inadequate without staff development.

Keeping current in content and best practice methodologies in their fields is a difficult task for many educators. Becoming aware of all the resources available in a given content area can be an even larger challenge. The Internet provides an efficient and powerful tool to assist in these tasks by allowing access to many teaching and learning resources through the World Wide Web (WWW or Web). The WWW opens doors for students and teachers to explore a vast "universe" of information. Still, connecting the appropriate resources of the WWW to classrooms can create many challenges for both students and teachers. These challenges come in two distinct areas: those pertaining to computer literacy and access, and those pertaining to how gathered information fits into the curriculum (Clark, Hosticka, Kent, & Browne, 1998).

The literature indicates that teachers who implement various forms of technology in their classrooms tend to move from teacher direction to greater student autonomy (Center for Applied Special Technology, 1996; Nicaise & Barnes, 1996; Owston, 1997; Rogan, 1995; Software Publishers Association, 1995). Owston (1997) showed that after exposure to Internet training, teachers have a tendency to change from didactic delivery systems to project-based approaches. Such transformations of teaching practices are key factors in achieving reform in mathematics and science education (American Association for the Advancement of Science, 1989; National Council of Teachers of Mathematics, 1989).

Because the teacher is crucial to designing learning environments that use the Internet for integrating science content and pedagogy, one important goal of educational programs should be to provide teachers with the skills necessary for the effective implementation of such technologies. Yet, studies indicate that teachers do not have adequate training in this area and the amount and quality of technology-oriented instruction for teachers must be increased (Willis & Mehlinger, 1996).

Educators who specialize in the study of professional development find that teachers value time spent developing practical skills applicable to their individual classroom settings. Guskey (1986) indicated that teachers should be provided with knowledge and skills that they perceive to have potential use in expanding their practices. In fact, teachers rate their technology skills so low that many consider themselves to be less computer literate than their students and, consequently, continue to request additional training in instructional technology (Northrup & Little, 1996).

Models of effective professional development indicate the importance of providing teachers with time to design a plan for using suggested materials and methods in their classrooms (Bosner & Daugherty, 1994). Schoefield (1995) asserted that computers generally fail to live up to expectations because teachers do not receive instruction on how to integrate technology into their teaching creatively. Teachers must learn skills not only in how to use technology but also in how to design and implement effective instructional plans that use technological resources.

Only in the past few years has a framework to support a systemic integration of computer literacy into teacher education programs been investigated. These efforts have been led by the International Society for Technology in Education (ISTE), which has provided foundational standards for preservice teacher education. The ISTE has outlined four categories for classifying computer literacy standards: (a) basic technology operations and concepts, (b) application of technology in instruction, (c) professional and personal use of technology, and (d) the societal, ethical, and human impact of technology (Handler & Strudler, 1997). Furthermore, researchers have supported the integration of technology across teacher education courses as opposed to presenting it as an isolated topic (Balli, Wright, & Foster, 1997; Merkley & Schmidt, 1996). These literacy guidelines are important for success in training teachers to use technology that meets the ISTE technology standards. Too often teachers view computers as isolated instructional resources that require more time above and beyond their normal teacher preparation tasks.

STATEMENT OF THE PROBLEM

The purpose of this study was to assess the extent to which selected middle and high school teachers from a diverse large urban school district use the Internet to enhance science teaching. The teachers' use of the Internet in their classrooms and how frequently they were using it as an instructional tool were assessed. The following research questions were addressed:

1. To what extent do middle and high school teachers use the Internet as a resource to enhance science teaching?
2. Are middle and high school science teachers familiar with some of the various websites (biology, chemistry, physical science, and environmental science) that are specifically intended to enhance science teaching?

3. In what ways do middle and high school science teachers use the Internet interactively with their students?

METHOD

Sample

Surveys were mailed to 53 teachers from a large diverse urban school district who had participated in one or more graduate level professional development courses in biology, chemistry, or physics. Thirty-one teachers (58.5%) returned their surveys. Table 1 shows the demographic data of the teachers who returned their surveys. Five teachers (16%) were middle school teachers and 26 (84%) were high school teachers. The sample consisted of 8 males (26%) and 23 females (74%). The age ranges of the teachers were: 7 between the ages of 20-30 (22%), 4 between 31-45 (13%), and 20 who were 46 years or older (65%). The number of years of teaching were: 1-5 years, 8 (26%); 6-10 years, 2 (6%); 10-15 years, 7 (23%); 16 years or greater, 14 (45%). The characteristics of the teachers surveyed regarding age range and the number of years of service reflect that of the school district.

Table 1
Demographic Data

	Number of Teachers	Percent
Teaching Level		
Middle School	5	16%
High School	26	84%
Gender		
Male	8	26%
Female	23	74%
Age 20-30	7	22%
31-45	4	13%
46+	20	65%
Years of Service		
1-5	8	26%
6-10	2	6%
11-15	7	23%
16+	14	45%

Instrument

The survey consisted of 20 items. The first section was made up of 6 questions, asking about demographic information such as whether the teacher taught at the middle or secondary level, the subject(s) taught, the grade(s) taught, gender, age range, and number of years of teaching. The second section consisted of 16 items concerning computer access and skills (see Appendix).

Procedure

This study was conducted to find out the extent to which selected middle and high school science teachers were using the Internet to enhance science instruction. Thirty-one teachers in this study had participated in one or more of six graduate level professional development courses in biology, chemistry, or physics. Each course consisted of 45 contact hours. In addition to intense content-relevant and pedagogical instruction, each of these courses also contained a component, about 25% (11.3 hours), on using the Internet (Table 2).

Table 2
Distribution of Time Spent on Internet Components of the Course

Science Specific Content & Pedagogy (lesson plans, experiments)	Problem Solving Activities (simulations, games)	Advanced Research Based Topics (human genome project, cloning, molecular basis of disease)
5.6 hr 50%	2.3 hr 20%	3.4 hr 30%

The teachers were given lists of selected websites for science content and pedagogy. The teachers used sites from these lists and searched the Internet for other sites to deepen their content knowledge and to gain ideas to develop innovative lesson plans.

Fifty-three selected middle and high school science teachers received a letter from the researchers, which contained a preamble to obtain their informed consent (as required by the University's Institutional Review Board (IRB) for Human Subjects). To participate in this study, teachers were asked to complete and return a survey assessing the extent to which they used the Internet for science teaching. An incentive of $15 was offered to each participant who completed the survey. To guarantee anonymity and to determine who had returned their surveys, a double return envelope system was used. Respondents were instructed to seal their completed surveys in an unmarked envelope that they were to place in a mailing envelope addressed to the study's principal investigators. The outer envelope identified respondents to indicate that they had returned their surveys. While receipt of the survey from each teacher was recorded, the sealed inner envelopes were collected unopened and were kept separate from the mailing envelopes.

Throughout the professional development courses teachers were encouraged to use the Internet as a catalyst to enhance science teaching. The use of the Internet was integrated into the content specific courses to facilitate learning about the subject area. The Internet was also used as a resource to augment their science content knowledge and to acquire pedagogical skills (i.e. lesson plans, engagement activities, and laboratory experiments). Teachers were shown how to make adaptations to their curriculum to make effective use of the Internet. Part of the course focused on pedagogic methods on the development of high-order reasoning and problem-solving skills.

To synthesize content information and laboratory experiments into teaching activities consistent with the state's performance guidelines and the school district's constructivist model (5 E's) for teaching science, a template was given to each teacher to use on the computer to design and input their lesson plan for each activity. The constructivist (5 E's) model uses a discovery approach and provides concrete learning experiences and encourages students to become active learners. For example teachers were given a problem-solving activity to find out the etiology of a disease. In small groups, they shared their prior knowledge before accessing the Internet. This activity and other problem-solving activities gave teachers insights on how to get students to explore and investigate a problem. Some of the main uses of the computer (i.e. extending student learning and challenging students to understand and construct new knowledge) for teaching science were discussed. The participants spent time looking at research projects, science fair topics, and projects that had been successfully done with students around the world on the Internet. Teachers were provided with addresses of websites on topics related to their existing curriculum.

Treatment of Data

Table 3 lists the three research questions and the survey questions which address them.

Table 3

Link Between Research Questions and Survey Questions

Research Question	Addressed by Survey Question Number
1.To what extent do middle and high school teachers use the Internet as a resource to enhance science teacher?	16, 17, 18, 20
2. Are middle and high school science teachers familiar with some of the various websites that are specifically intended to enhance science teaching?	9, 10, 13, 14
3. In what ways do middle and high school science teachers use the internet interactively with their students?	7, 8, 15

RESULTS

To address research question #1: "To what extent do middle and high school teachers use the Internet as a resource to enhance science teaching?," the responses to the survey questions 16, 17, 18, and 20 (Appendix) were applicable.

Question 16. *On the average how many hours a week do you use the Internet?* ***Please indicate how many hours a week on average do you do the following.***

Use	Hours per week	Percent of Total Hours
Academic e-mail	0.71 ± 1.41	8.1%
Personal e-mail	2.39 ± 3.37	27.3%
Science Teaching Content	1.73 ± 2.43	19.7%
Other Teaching Content	0.98 ± 1.78	11.2%
Science Teaching Pedagogy	0.69 ± 1.49	11.2%
Entertainment/Games	0.45 ± 0.93	5.1%
News/Sports	0.44 ± 0.81	5.0%
Other	1.34 ± 2.20	12.4%

The areas on which the responding science teachers spent the greatest amount of their online Internet time were personal e-mail, science teaching content, other teaching content, science teaching pedagogy and other. The large standard deviations of the average hours per week spent on these activities reflect the large variation in the time spent by the individual respondents. Additionally, zero hours were entered for many of the categories by the respondents, and a very large number of hours for some categories were listed by few of the respondents. Therefore, the standard deviation for each of these categories is larger than the average (mean) value.

If we divide the 31 respondents into three groups based upon the amount of total usage, the standard deviation of each group becomes reasonable. The distribution of hours per week spent by the respondents appears in Figure 1. The three groups based upon usage are the (a) high usage group which used the Internet 11.5 hours or more per week, the (b) medium usage group which used the Internet from 3-7 hours per week, and the (c) low usage group which used the Internet less that 3 hours per week.

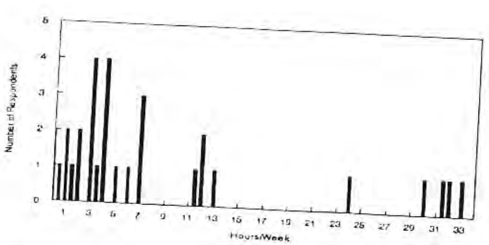

Figure 1. Internet usage

The pedagogical usage is defined as the sum of the hours spent by teachers on the (a) Internet for Science Teaching Content, (b) Other Teaching Content, and (c) Science Teaching Pedagogy). Tables 4-A, high usage group, Table 4-B, middle usage group, and Table 4-C, low usage group, shows the percentage of total use of the Internet for pedagogical usage for each respondent in that particular usage group. Also, shown in these Tables are the teaching level (middle school, MS or high school, HS), the gender of the respondent (male, M or female, F), the age range (20-30, 31-45, and 45+ years), and the years of service (1-5 years, 6-10, 11-15, and 16+ years).

In Table 4-A, the average total weekly usage of the high usage group was 22.1 hours (*SD* 9.8) and the percentage of pedagogical use was 38.4% (*SD* 13.4%). The demographic characteristics of the high usage group of 9 respondents are: 7 (77.8%) high school teachers and 2 (22.2;%) middle school teachers; 7 (77.8%) female and 2 male (22.2%); 4 (44.4%) who are 20-30 years old and 5 (55.6%) who are 46 years old or older; and 3 (33.3%) who have 1-5 years of service, 2 (22.2%) who have 10-15 years of service, and 3 (33.3%) who have greater than that 16 years of service. Of the 9 respondents in the high usage group, 5 (55.5%) rated themselves as having an intermediate level of computer expertise and 4 (44.6%) rated themselves as having an advanced level. Six (66.7%) rated themselves as having an intermediate level of expertise in Internet use and 3 (33.3%) rated themselves as having an advanced level (survey questions 9 and 10).

Table 4-A

The High Total Computer Usage Group

Survey #	Middle (MS) or High School (HS)	Gender (M/F)	Age (yrs)	Service (yrs)	Computer Expertise	Internet Expertise	Total Use (hr)	Pedagogical Use (%)
3	HS	F	46+	16+	Inter	Inter	11.5	39.1
5	HS	F	20-30	1-5	Inter	Inter	12	16.7
6	HS	F	20-30	1-5	Adv	Adv	12	41.7
9	HS	F	20-30	10-15	Inter	Inter	31.5	50.8
10	HS	F	46+	16+	Adv	Adv	30	46.7
16	HS	M	46+	10-15	Adv	Inter	32	40.6
17	MS	M	46+	16+	Inter	Inter	13	15.4
22	MS	F	20-30	1-5	Adv	Adv	33	39.4
31	HS	F	46+	10-15	Inter	Inter	24	54.2
High Group Avg							22.1	38.4
SD							9.81	13.4
Overall Avg*							3.4	39.1

*Overall Avg is the average of high, middle, and low usage groups.

In Table 4-B, the average total weekly usage of the middle usage group was 4.5 hours (*SD* 1.6) and the percentage of pedagogical use was 44.0% (*SD* 26.4). The demographic characteristics of the middle usage group of 14 respondents are: 13 (92.9%) high school teachers and 1 (7.1%) middle school teacher; 11 (78.6%) female and 3 (21.4%) male; 2 (14.3%) who are 20-30 years old, 3 (21.4%) who are 31-45 years old, and 9 (64.3%) who are 46 years old or older; and 3 (21.4%) who have 1-5 years of service, 2 (14.3%) who have 6-10 years of service, 3 (21.4%) who have 10-15 years of service, and 6 (42.9%) who have greater than that 16 years of service. Of the 14 respondents in the middle usage group, 5 (35.7%) rated themselves as having a novice level of computer expertise, 8 (57.1%) rated themselves as having an intermediate level, and one rated him/herself as having an advanced level. Three (21.4%) rated themselves as having a novice level of expertise in Internet use and 11 (78.6%) rated themselves as having an intermediate level of expertise (survey questions 9 and 10).

Table 4-B

The Middle Total Computer Usage Group

Survey #	Middle (MS) or High School (HS)	Gender (M/F)	Age (yrs)	Service (yrs)	Computer Expertise	Internet Expertise	Total Use	Pedagogical Use (%) (hr)
2	HS	F	46+	16+	Inter	Inter	4	37.5
4	HS	F	31-45	1-5	Inter	Inter	7	57.1
7	HS	F	46+	1-5	Novice	Inter	4	25
8	HS	F	20-30	6-10	Inter	Inter	4	25
11	HS	F	46+	10-15	Inter	Inter	3	50
13	MS	F	46+	16+	Novice	Novice	5	40
14	HS	M	20-30	1-5	Inter	Inter	3.5	14.3
19	HS	F	31-45	10-15	Inter	Inter	7	85.7
20	HS	M	46+	16+	Inter	Inter	3	33.3
21	HS	F	46+	16+	Inter	Inter	7	14.3
23	HS	M	31-45	6-10	Adv	Inter	6	16.7
24	HS	F	46+	10-15	Novice	Novice	4	50
25	HS	F	46+	16+	Novice	Inter	3	100
27	HS	F	46+	16+	Novice	Novice	3	66.7
Middle Group Avg.							4.5	44.0
SD							1.57	26.4
Overall Avg.*							3.4	39.1

*Overall Avg. is the average of high, middle, and low usage groups.

In Table 4-C, the average total weekly usage of the low usage group was 1 hour (*SD* 0.8) and the percentage of pedagogical use was 12.5%. The demographic characteristics of the low usage group of 8 respondents are: 6 (75%) high school teachers and 2 (25%) middle school teacher; 5 (62.5%) female and 3 (37.5%) male; 1 (12.5%) who is 20-30 years old, 1 (12.5%) who is 31-45 years old, and 6 (75%) who are 46 years old or older; and 2 (25%) who have 1-5 years of service and 6 (75%) who have greater than that 16 years of service. Of the 8 respondents in the low usage group, 1 (12.5%) rated him/herself as having no computer expertise, 3 (37.5%) rated themselves as having a novice level of expertise, and 4 (50%) rated themselves as having an intermediate level. One (12.5%) rated him/herself as

having no expertise in Internet use, 5 (62.5%) rated themselves as have a novice level of expertise, and 2 (25%) rated themselves as having an intermediate level of expertise (survey questions 9 and 10).

Table 4-C

The Low Total Computer Usage Group

Survey #	Middle (MS) or High School (HS)	Gender (M/F)	Age (yrs)	Service (yrs)	Computer Expertise	Internet Expertise	Total Use (hr)	Pedagogical Use (%)
1	HS	F	20-30	1-5	Inter	Inter	2	0
12	MS	F	46+	16+	Novice	Novice	2	0
15	HS	F	31-45	16+	Novice	Novice	1	0
18	HS	M	46+	1-5	Inter	Novice	1	0
26	HS	F	46+	16+	None	None	0	0
28	HS	M	46+	16+	Novice	Novice	0	0
29	MS	F	46+	16+	Inter	Inter	1.5	100
30	HS	M	46+	16+	Inter	Novice	.5	0
Low Group Avg.							1	12.5
SD							0.80	35.4
Overall Avg.*							3.4	39.1

*Overall Avg. is the average of high, middle, and low usage groups.

Question 17. *Please rate the following benefits for Internet access in the classroom.*
1 for the "most beneficial," 5 for the least beneficial.

Benefits	Rank 1 2 3 4 5	Avg Response
Motivational tool	9 6 7 0 5	2.5
Improvement of problem solving skills	5 9 7 2 4	3.0
Greater collaboration between students and teachers	5 10 4 4 4	2.7
Little or no access	2 3 5 2 10	3.7
Other (please specify):	None	

These results were analyzed by taking a weighted average of each item by summing the product of the number of responses for each rating and the value of the corresponding rating and dividing that sum by the total number of responses for that item. Specifically for the "Motivation tool" item, the weighted average was calculated as follows:

(9x1 + 6x2 + 7x3 + 0x4 + 5x5)/(9 + 6 + 7 + 0 + 5) = 2.5

Although the average response of 2.5 for the "Motivational tool" item appears to indicate that the respondents felt that Internet access is slightly beneficial since a rank of 3 is midway between most and least beneficial, the response which was most selected (the mode) by 9 of 27 teachers responding to this item was 1, most beneficial. For the second item, the average response was 3, but 2 was the response which was selected by 9 of 27 respondents indicating that the greatest number of respondents thought that Internet access in the classroom was very beneficial for the "improvement of problem solving skills." The greatest number of teachers (the mode), 10 of 27 responding to the third item, "Internet access in the classroom promotes greater collaboration between students and teachers," felt that the Internet was very beneficial selecting a rank of 2. The average response for this question was 2.7.

When asked to rank on a scale from 1 to 5 (where 1 is the most changed and 5 is no change) with regard to changes in their teaching methods since using the Internet, the following responses were given:

Question 18. Teaching Strategy

	Rank	Avg Response
	1 2 3 4 5	
A shift in instruction from textbooks to project-based methodology	3 6 9 6 4	3.2
More individualized student attention	1 5 8 7 7	4.1
A shift from teacher-centered lessons to student-centered lessons	2 7 9 6 4	3.2

The average response (weighted average) of 3.2 and a mode of 3 with 9 of 28 responses for the "A shift in instruction from textbooks to project-based methodology" item indicates that the respondents believed that using the Internet encouraged them to somewhat change their teaching methods since a rank of 3 is midway between "most changed" and "no change." For the second item, the average response of 4.1 and a mode of 3 (8 of 28 responses) indicates that the respondents believed that the Internet encouraged them to pay only slightly more individualized attention to their students. An average response of 3.2 and a mode of 3 (9 of 28 responses) indicates that the respondents believed that the Internet did not greatly contribute to "a shift from teacher-centered lessons to student-centered lessons."

Question 20. *How does using the Internet fit in your existing curriculum?*

Question 20 is an open-ended question to which the respondents wrote short responses. These responses were sorted into the six categories listed in Table 5. Of the 12 (38.7%) who said they assisted students with research related projects, 2 (6.5%) of these obtained lesson plans, projects, and laboratories from the Internet, and 1 (3.2%) described getting curriculum related activities. Six (19.4%) stated they used the Internet to search for more information about research content, of these 2 (6.5%) obtained lesson plans, projects, and laboratories. One teacher (3.2%) reported noncurricular use such as e-mail correspondence with parents, 8 (25.8%) reported little on no use of the Internet.

Table 5

Use of the Internet in Existing Curriculum

	Assist Students with Research	Teachers Research Content	Lesson Plans Class Projects, and Labs	Curricular Related Activities	Non-Curricular Activities (E-mail)	Little or No Access to the Internet
Number of Respondents*	12	6	7	4	1	8
Percent of all Respondents	38.7%	19.4%	22.6%	12.9%	3.2%	25.8%
*N = 31						

To address research question 2: "Are middle and high school science teachers familiar with some of the various websites that are specifically intended to enhance science teaching?," responses to survey questions 13 and 14 were considered.

Question 13. *Are you familiar with specialized websites for teaching science?*
20 (65%) Yes, 11 (35%) No

Question 14. *Are you familiar with specialized websites for content knowledge (i.e. biology, chemistry, etc.)?*
24 (77%) Yes, 7 (23%) No

Questions 13 and 14 asked the respondents whether they knew of specialized websites for teaching science and for obtaining science content knowledge. Twenty (64.5%) of the respondents said that they were familiar with specialized websites for teaching science and 11 (35.5%) said they were not. Twenty-four (77.4%) of the teachers responding said that they were familiar with specialized websites for content knowledge and 7 (22.6%) said they were not.

To address research question 3: "Can middle and high school science teachers use the Internet interactively with their students?," the responses from survey questions 7, 8, and 15 were considered.

Question 7. *Where do you have Internet access in your school? Check all that apply, classroom, computer lab and media center, specify other.*

Question 8. *Do you have the capability of projecting a single computer screen for whole class instruction?*

Question 15. *Do your students have hands-on use of the Internet (not computer software programs, CD ROMS)?*

Of those responding, 22 (71.0%) indicated they had access to the Internet in the classroom, 22 (71.0%) indicated they had access in the computer lab, and 19 (61.3%) indicated they had access to the Internet in a media center. Only 12 (38.7%) of the respondents stated that they had the capability of projecting a single computer screen for whole class instruction and 19 (61.3%) indicated that students had hands-on use of the Internet.

DISCUSSION AND CONCLUSIONS

One of the goals of the professional development courses was to assist teachers to use the Internet to link pedagogy and content to enhance their science teaching. These sessions gave participants the opportunity to practice the skills they had learned during the professional development courses and to explore possible resources for the units they were planning to implement in their classroom.

The teachers indicated that encouraging them to use the Internet somewhat changed their teaching methods. The majority of the teachers believed that the Internet was a most beneficial motivational tool, that it greatly improved problems solving skills of their students, and that it was most beneficial to contributing to greater collaboration between students and teachers. Teachers used the Internet to enhance their science teaching by researching their content, using lessons plans and other curricular related materials.

Some teachers mentioned allowing students to do research topics on the Internet related to the content they taught. Many of the teachers assisted the students more with research projects than retrieving lesson plans and other curricular activities from the Internet. The data also revealed the respondents felt that the Internet did not greatly contribute to "a shift from teacher-centered lessons to student-centered lessons."

The ways the teachers reported using the Internet as an instructional tool show that it is important to integrate the use of the Internet into professional development retraining courses. The teachers can be shown how to become involved in collaborative projects, introduced to virtual libraries, and be provided with information to facilitate their ability to communicate with peers and experts world-wide. Such integration gives teachers the opportunity to experience exactly how the Internet can be an integral part of the daily operations of the classroom.

Although a component of the professional development courses encouraged teachers to use the Internet to augment their science content knowledge and to acquire pedagogical skills (i.e. lesson plans, engagement activities, laboratory experiments), there was a small percentage of teachers who did not use the Internet. The data clearly show that some teachers use the Internet far more for instruction than other teachers, but does not indicate what might account for the differences in use. The pedagogical use of the Internet was found to be related to the three levels of Internet usage: High usage (greater than 11.5 hours per week), medium usage (3 to 7 hours per week), and low usage (2 or less hours per week). It was noted that those teachers who rated their Internet expertise as advanced spent more time on the Internet than those who rated themselves as intermediate or novice. It was noted in the data that teachers in the low usage group use the Internet an average of one hour per week. Although very few teachers in this study were not using the Internet, there can be many reasons why there is a lack of the use of the Internet in the classroom. For example, obsolete and inaccessible computer systems, high student/computer ratios, and a lack of appropriate building infrastructure and network connectivity. It is important that teachers do not allow these problems to divert attention from the ways in which the Internet should actually be used within an educational context.

To make effective use of educational technology, teachers will have to master a variety of powerful tools. Data from the surveys revealed that a high percentage of teachers were familiar with using specialized websites for obtaining science content knowledge and pedagogy. Over 65% of the teachers stated they were skilled in using various websites. Teachers can use the Internet to create and present class resources such as handouts, prior student work, class notes, and *Power Point* presentations. By using the Internet to enhance science instruction, teachers can rely less on didactic lectures and become more like guides or facilitators of student learning.

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Appendix
Internet Survey

SECTION 1 Respondent Characteristics

Please place a check on the appropriate line.

1. ___Middle School Teacher ___High School Teacher

2. What subject(s) do you teach? ________________

3. What grades do you teach? ___6-8 ___9-12

4. ___Male ___Female

5. Age range ___20-30 ___31-45 ___46 and up

6. Number of years of teaching ___1-5 ___6-10 ___11-15 ___16+

SECTION 2 Computer Access/Skills

7. Where do you have Internet access in your school? Check all that apply.

___classroom ___computer lab ___media center Other (please specify)

8. Do you have the capability of projecting a single computer screen for whole class instruction? ____Yes ___No

9. Rate your computer expertise ___none ____novice ___intermediate ___advanced

10. Rate how well you use the Internet ____none ___novice ____intermediate ___advanced

11. Which search engine(s) do you use? (Check all that apply) ___yahoo ___alta vista ___lycos ___excite ___other (please specify)

12. Do you know how to constrain your search results such that all results satisfy more than one search criteria? ___Yes ____No

13. Are you familiar with specialized websites for teaching science? ___Yes ___No

14. Are you familiar with specialized websites for content knowledge (i.e. biology, chemistry, etc.) ___Yes ____No

15. Do your students have hands-on use of the Internet (not computer software programs, CD ROMS)? ____Yes ____No

16. On the average how many hours a week do you use the Internet? Please indicate how many hours a week on average do you do the following.

Use	Hours per week
Academic e-mail	____
Personal e-mail	____
Science Teaching Content	____
Other Teaching Content	____
Science Teaching Pedagogy	____
Entertainment/Games	____
News/Sports	____
Other	____

17. Please rate the following benefits for Internet access in the classroom. 1st for the "most beneficial," 5th for "least beneficial"

Benefits	Rating
Motivational tool	1 2 3 4 5
Improvement of problem solving skills	1 2 3 4 5
Greater collaboration between students and teachers	1 2 3 4 5
Little or no access	1 2 3 4 5
Other (please specify)	

18. Please rank the following items regarding the changes in your teaching method since using the Internet: 1st for "most changed," 5th for "no change"

Teaching Strategy

Rank	
A shift in instruction from textbooks to project-based methodology	1 2 3 4 5
More individualized student attention	1 2 3 4 5
A shift from teacher-centered lessons to student centered lessons	1 2 3 4 5

19. Do you use a personal computer at home? ___Yes ____No

20. How does using the Internet fit in your existing curriculum?

Assessing Secondary Science Teachers' Perceptions on Teaching Students with Disabilities

Abstract

One-hundred-and-twenty secondary science teachers responded to a survey entitled "Teaching Science to Students with Special Needs in Inclusive Settings" to assess their perception of teaching with students with disabilities in the science classroom. The authors focused on the following questions: (1) How does the secondary science teacher with no previous training adjust his/her teaching strategies when working with special needs students? (2) What resources can the secondary science teacher incorporate to assist students who have specific disabilities? and (3) What challenges, if any, do science teachers experience in inclusive settings? The authors propose research-based methods used for assisting science teachers when working with special needs students. A qualitative and quantitative data design was used to analyze the data. Results of the survey suggested that the 120 secondary science teachers surveyed needed support in order to be more effective when teaching students with disabilities.

Introduction

Students with one or more identified physical, cognitive, emotional, or other types of disabilities compose 11.5 % of the estimated K-12 student population in the United States (U.S. Department of Education, 2002). Students with disabilities generally do not perform as well in science as their peers with no identified disabilities. They receive lower grades in science (Parmar & Cawley, 1993). Although students with disabilities have a range of cognitive, physical and emotional functioning, there is no reason to think that students with disabilities learn science differently than other students (Lynch, Taymans, Watson, Ochsendorf, 2007. The *National Science Education Standards* (National Research Council, 1996) and *Benchmarks for Science Literacy* (AAAS, 1993), call for science literacy for all students. If all students are expected to understand and apply science concepts in real life situations as well a performing the process skills (i.e. observe, predict, infer and experiment), secondary science teachers should be prepared to vary instruction to meet the needs of all students.

Background Literature

There is some research that describes the kind of science experiences that help students with disabilities learn science concepts, as they increase their process skills. Students with disabilities who use hands-on or activity-based curriculum materials have been shown to understand and retain science concepts more fully that peers who learn from text-based approaches. According to various organizations and mandates such as Public Law (PL) 94-142 (1975), special education and science education have become inextricably connected over recent years. PL 94-142 states that all individuals with a handicap should be offered a free appropriate public education which emphasizes special education and related services designed to meet their unique needs, to assure that the rights of handicapped children and their parents or guardians are protected, to assist States and localities to provide for the education of all handicapped children and to assess and assure the effectiveness of efforts to educate handicapped children.
(http://asclepius.com/angel/special.html, 2006)
Congruently, the National Science Education Standards unequivocally support all students' presence and participation in inquiry-based science classrooms (National Research Council,

1996). Moreover, the "No Child Left Behind" (NCLB) Act strongly affirms that all students including those with disabilities can achieve high standards. NCLB. works in conjunction with the Individuals with Disabilities Education Act of 1997 (IDEA), the nation's special education law. Under this law, students with disabilities must have equal access to the same high-quality curriculum and instruction as other students. As students with specific learning needs are mainstreamed, classrooms are becoming more diverse. This shift is due to federal legislation and science education reform. Educational and behavioral research also reveal that all students benefit from the inclusive classroom setting (Kochlar, West, & Taymans, 2000).

Although the growing importance of science education for students with disabilities has been recognized, (Irving, Nti & Johnson, 2007) found that many students with disabilities receive very little or no science instruction. The research literature reveals that science teachers are confronted with several challenges, primarily due to lack of preparation, when teaching in a diverse science classroom. For example, many special and general educators have not been adequately prepared to teach science to students with disabilities (Gurganus et al., 1995). Teachers often either use a content-oriented approach that focuses on learning vocabulary or factual text-based information through textbooks and teacher-directed presentations such as lectures and demonstrations (Mastropieri & Scruggs, 2003; Weiss, 1993). The content-oriented approach requires students to have adequate levels of reading, writing, and memory skills; thus, many students with disabilities do not benefit from this method (Mastropieri & Scruggs, 1993). Studies suggest that students with disabilities can learn and master content in the general education curriculum when teachers employ instructional adaptations based on researched-based effective practices (Grossen & Carnine, 1996; Scruggs & Mastropieri, 1993). Successful science teaching approaches include tutoring, cooperative learning, mnemonic strategies, and self-monitoring strategies (Mastropieri & Scruggs, 1995). With appropriate teaching methods and resources, the diverse environment can provide opportunities for professional growth and increase student achievement (Peters & Johnson, 2006). Taking into account student ideas is a suggestion for teachers to find out what their students think about the benchmarks in science. Providing first-hand experiences and allowing students to practice the processes of science are effective instruction for diverse learners. These types of instruction imply recognition of individual differences and the need to provide students with explicit goals, hands-on experiences, and teaching modeling or scaffolding of scientific reasoning (Lynch, Taymans, Watson, Ochsendorf, 2007).

All students should have the most competent teachers with an in-depth understanding of the subject matter to ensure that grade level standards are met. These requirements apply whether the teacher provides core academic instruction in a regular classroom, a resource room or another setting. General education and special education teachers need to be knowledgeable and skilled of varied teaching strategies that are applicable for all diverse students, including students with special needs and disabilities, so that all students can achieve to high academic standards.

Schumm, Vaughn, Gordon, and Rothlein (1994) suggest that teachers are not likely to change their teaching behavior unless they are given the skills, knowledge, and confidence to do so. When new skills and new content knowledge are presented over a series of training sessions that include a limited amount of information, followed by opportunities for classroom practices with coaching, changes in teaching become evident (Guskey, 1986).

Given that special education is more demanding than mainstream education. Wolfendale (1992) emphasizes that the skills and expertise needed for special needs teaching are clearly different from the teaching skills required for mainstream learners. Bos and Vaughn (1994) also contend that teachers need special training for students with special needs. Since the majority of students with special needs are taught science in general education classrooms, it is incumbent that the secondary science teacher receives instructional support systems so students can become competent and knowledgeable of the processes, concepts, and principles of science (Bos and Vaughn, 1994).

Purpose
Secondary science teachers were surveyed to assess their perceived knowledge and preparation in working with students with disabilities in the science classroom. The results of the survey were analyzed to address the following focus areas:

(1) How does the secondary science teacher with no previous training adjust his/her teaching strategies when working with special needs students?
(2) What resources can the secondary science teacher incorporate to assist students who have specific disabilities?
(3) What challenges, if any, do science teachers experience in inclusive settings?

Methodology
One hundred and twenty (120) secondary (middle and high) science teachers from the Washington, DC metropolitan area participated in a long-term professional development project funded by the National Science Foundation. The participants responded to a seventeen-item survey entitled *Teaching Science to Students with Special Needs in Inclusive Settings.* The data were collected and analyzed using the Chi-Square statistical technique. A qualitative and quantitative data design was used to analyze the data.

Results
Participants responded to a survey entitled "*Teaching Science to Students with Special Needs in Inclusive Settings*" to assess their knowledge and preparation for working with special learners (see Table 2).

Sixty percent of the participants surveyed taught at the junior high/middle school level and 40% taught at the high school level. Of this number, 66% were female teachers and 34% were male. The participants represented diverse ethnic groups. A significant number (26.6%) of the participants had 20 or more years of teaching experience while 45.1% had obtained a Bachelor's level education and 33.1% of the participants had a master's degree. Ninety-six per cent of the teachers were certified (including provisional and temporary certification) in a science content. A detailed description of participating teacher characteristics is shown in Table 1. Results of the survey revealed that all of the 120 teachers surveyed perceived that they needed additional support in order to be more effective in teaching science to special learners.

Table 1

Characteristics of Participating Teachers

Participating Schools	
Junior High/Middle School	60.0%
Senior High School	40.0%
Gender	
Male	34.0%
Female	66.0%
Race	
African American	72.1%
White	13.6%
Native American	0.6%
Hispanic	1.3%
Mixed Race	1.3%
Other	11.0%
Degree	
Bachelor's Level	45.1%
Bachelor's + Grad Credits	4.0%
Master's Level	33.1%
Master's + Grad Credits	3.4%
2^{nd} Master's Degree	4.0%
Professional School Level	2.3%
Ph. D. Level	8.0%

Years of Experience	
0-4	35.1%
5-10	21.4%
11-15	7.8%
16-20	9.1%
> 20	26.6%
Certification	
Certified	68.9%
Provisional or Temporary	25.8%
Only	1.3%
Both	4.0%
Other	

The results of the survey, were analyzed and summarized (see Table 2). The data focused on three questions that address the participants' perception of teaching students with disabilities.

(1) How does the secondary science teacher with no previous training adjust his/her teaching strategies when working with special needs students?
(2) What resources can the secondary science teacher incorporate to assist students who have specific disabilities?
(3) What challenges, if any, do science teachers experience in inclusive settings?

How does the secondary science teacher with no previous training adjust his/her teaching strategies when working with special needs students? Of the 120 teachers surveyed, 18 (15%) reportedly received staff development training related to students with special needs. Eighty-five percent (102) of the participants revealed that they did not have previous training working with students with specific disabilities. These teachers recognized their need for special training. When working with mainstreamed special needs students, teachers indicated that they grouped students by ability levels. They stated that short attention span or lack of understanding of special needs students contributed to behavioral challenges. The teachers stressed that when two or more students with special needs who are placed in a classroom, they acquire additional responsibilities and additional work. Teachers felt that they tried to adapt activities and materials to ensure the participation of learners with special needs. However, they emphasized the need for information and ideas regarding appropriate teaching styles for special needs and inclusive students.

What resources can the secondary science teacher incorporate to assist students who have specific disabilities? The participants expressed the need for modified materials aligned to their science curricula but that were adjusted to the students' learning abilities. Teachers also expressed the need for classroom aides or assistants to assist them in the implementation of lesson plans and classroom activities/curriculum.

What challenges, if any, do science teachers experience in inclusive settings? Participants stressed that under the current guidelines, students with special needs must meet the same high standards as all students in the classroom. The teachers' challenge is how to accomplish this mandate. They believe that "watering down of the curriculum" is a disservice to all. With the push for placing special needs students in inclusive classrooms, science teachers recognize the need for continuous training and additional resources to that they can effectively teach students with diverse learning styles.

Conclusion

Teachers implied through the survey that they need more professional development in order to adapt and modify materials and procedures to meet the needs of the special learner. Resources are needed to incorporate activities into lesson that engage all learning modalities-visual, auditory, tactile, and kinesthetic.

Many of the teachers expressed that providing appropriate special education and related services, i.e. aids and supports in the regular classroom to teachers are very important. Additionally important is high quality intensive professional development for all personnel (the science teacher, aids, and special education teachers) to ensure that they have the necessary skills and knowledge that will enable them to meet the needs of the diverse learners in the inclusive science classroom.

Recommendations

Experiential learning is very important for all students, but especially those with learning disabilities who often do not benefit from the traditional lecture model. The use of co-teaching model is necessary and would allow for structuring instructional activities that would respond to the needs of diverse learners. One example of the co-teaching model is that the science teacher can provide the primary instruction while the special education teacher moves through the classroom providing individual instruction; ensuring students understand the concepts and skills. Both the science teacher and the special education teacher bring valuable skill sets and expertise. Students benefit from both the content expertise of the science teacher and the process expertise of the special education teacher.

It is recommended that teachers in inclusive science classrooms employ the following instructional practices:

1. Establish multiple learning centers within the classroom.
2. Make learning meaningful by integrating learning with life experiences.
3. Establish a structured learning environment.

4. Provide ongoing and frequent monitoring of individual student learning (formative assessment).
5. Implement interactive computer programs and multimedia tools.
6. Incorporate small group and cooperative learning strategies.
7. Develop an inquiry-centered curriculum

All students find science exciting and relevant when it is taught as an active rather that is a passive process. When students can relate what they are learning to their everyday lives, they feel a sense of ownership to the subject. It is important for science teachers to consider and be aware of the needs of individual students. These diverse needs should be reflected in the curriculum. The science teacher of special needs learners must do much more that simply follow a fixed and prescribed curriculum, because the science teacher constantly has to adapt to the specific and unique special needs of the learner. The science teacher must ensure that all students are involved some way at each level of instruction. Cooperative groups can be useful as they enable all students to participate in activities.

The authors suggest the following 8 steps to science teachers who desire to modify their teaching styles to provide equitable education to all students.

1. Re-write a science activity so that it is adapted to the learning abilities of the special needs student. For lessons whose jargon is difficult to understand, the directions should be re-written. Adaptations made to existing science lessons can be more accessible to students with learning difficulties.
2. Use a re-written activity to focus on a specific skill.
3. Adjust the classroom environment (e.g. the arrangement of the room, reduce distractions; have a special education teacher or aide in the classroom).
4. Use manipulatives, demonstrate concepts, use small group instruction, incorporate a multi-modal teaching approach that includes auditory, visual and tactile modes.
5. Adapt reading and activity sheets to match the reading/comprehension level of the student. Shorten assignments. Give directions in small distinct steps.
6. Modify grading system as appropriate to match the student's individual educational plan.
7. Apply techniques such as acting out lessons or role playing (e.g. parts of the cell, atom, rotation of the sun etc.). They should make use of sensory techniques in their lessons.
8. Provide alternative options for homework assignments and grading procedures.

Examples of programs designed especially for special-need learners include "Science Activities for the Visually Impaired" and Science Enrichment for Learning with Physical Handicaps," both developed at Lawrence Hall of Science at the Berkeley campus of the University of California (http://www.His.Berkely.edu). Additionally, there are many books, websites, and organizations for adapting science activities to meet the needs of students with physical disabilities or learning difficulties.

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Table 2

Survey: Teaching Science to Students with Special Needs in Inclusive Settings
Please respond to the following questions or statements. Circle the answer where applicable.

1. Were you initially trained as a teacher? Yes No
2. In which specialty area were you trained as a teacher? ____________________
3. How many years have you taught in schools? ____________________
4. Have special/inclusive students been identified in your class(es) Yes No
5. If you taught included students, have you ever read their IEP's? Yes No
6. If you were not initially trained as a special education teacher, what was your area of training? ____________________
7. Which content area do you currently teach? ____________________
8. If you have taught included students, did you get the human support you needed?

Selected Book Chapters

Dr. Marilyn Irving

Teaching Culturally Diverse College Students in a Pluralistic Society

Teaching Culturally Diverse College Students in a Pluralistic Society

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Edited by
Vernon L. Farmer
and
Evelyn Shepherd-Wynn

Contents

Dedication

For my son, Vernyatta Lee, and all the students of color who represent the new America. **V.L.F.**

For my daughter, Jordan Alexis, who has a strong desire to learn about students of color throughout the world. **E.S.W.**

Preface

The new millennium is one of great challenge for diversity in American higher education. Christensen and Tafel (1990) define diversity as difference in perspective, experience, culture, [and] attitude all which present challenges and opportunities to faculty and administrators in the new millennium (p. v). Teaching culturally diverse students in a pluralistic classroom is perhaps a more formidable challenge for faculty than at any time in our history. Today, higher education institutions are seeking answers to the complex issues of access, admission, retention, and graduation of culturally diverse students. With the rapidly growing body of research of what works with culturally diverse students on college campuses, higher education institutions have developed the expertise and resources necessary to meet the needs of this new student population.

Because of the cultural differences these students bring to the college classroom, they often do not respond well to the traditional methods of instruction. Consequently, a cadres of scholars have researched nontraditional instructional methods employed in a pluralistic classroom, including collaborative (or cooperative) learning (Bruffee, 1999; Johnson, 1990; Johnson & Johnson, 1991; Sharon, 1980; Slavin, 1989, 1990; Shepherd-Wynn, Cadet, & Pendleton, 2001), critical thinking (Berman, Hultgam, Lee, Rivkin, & Roderick, 1991; Newmann, 1990, 1992), electronic learning (Bagdikian, 1987, Brown, 1988), and self-regulated learning (DuBois, 2001; Zimmerman & Schunk, 1994). Faculty, then, should review this research to identify instructional methods and. techniques that may enhance their teaching effectiveness in a pluralistic classroom.

Meanwhile, higher education professionals should recognize the integrity and value of students cultural differences and assume full responsibility for preparing faculty to teach students from culturally diverse groups. Therefore, the goal of higher education should be to help faculty improve their teaching effectiveness with all students regardless of their culture, race or ethnicity, sex, age, socioeconomic status, or special needs.

In the book, *Teaching Culturally Diverse College Students in a Pluralistic Society*, the chapters focus primarily on faculty, instructional, and curricular activities concerned with teaching in a pluralistic society. The authors present pedagogical, instructional, and curricular methods recommended for teaching students from culturally diverse groups. The authors specifically focus on some of the nontraditional teaching methods that tend to be more effective and productive than the traditional teaching methods and techniques used in the typical college classroom. The book details some of the exemplary teaching and instructional practices employed in higher education to address the educational needs of a culturally diverse student population. However, this book includes only a sample of the efforts underway in colleges and universities today.

Deborah B. Smith, in Chapter One, examines African American students perceptions of remedial education programs and the implications of these perceptions for effective pedagogy in the college classroom. She contends that it is uncommon to find a college or university without some kind of compensatory or basic skills activity to support their students. Meanwhile, in Chapter Two, Ernesta P. Pendleton discusses the role of faculty development in response to a changing student clientele in higher education. The chapter raises three major questions: a) Are the celebration of diversity and improvement of retention compatible or are they fundamentally opposed given the current structure and culture of higher education? b) What is necessary for faculty to address the needs of culturally diverse student populations to the extent that their retention and graduation are assured? and c) Are colleges and universities prepared to do what it takes to accomplish both goals?

Rebecca S. Metzger, in Chapter Three, views the challenge for

teaching in a pluralistic society as one of enhancing student ownership in the learning process. The chapter s emphasis is on maximizing students learning through the utilization of learning styles to enhance culturally diverse students learning outcomes. The author suggests that by drawing upon different learning styles or preferred methods of learning in the classroom, the teacher can enhance student ownership in the learning process. The author discusses some ideas from existing resources on learning styles which have worked well with culturally diverse students in the past.

Evelyn Shepherd-Wynn, Neari F. Warner, and Vernon L. Farmer, in Chapter Four, recommend collaborative learning as an instructional method to teach culturally diverse students across the college curriculum. In the chapter, the authors show how collaborative learning can be used in various disciplines to enhance students learning outcomes.

Augusta A. Clark and Felicie M. Barnes, in Chapter Five, identify and describe strategies and resources needed to integrate and infuse technology in developmental education. The authors examine the connectiveness of the teaching and learning process that involves students, teachers, instruction, curriculum, and technology. They argue that faculty must place learning first and reexamine strategies and fundamental processes in this new concept - teaching and learning through technology.

Marilyn Irving and Leon A. Dickson, Jr., in Chapter Six, examine issues relevant to cultural diversity in the science classroom and present ideas on using pedagogy to enrich the learning of science for culturally diverse college students. The authors offer suggestions for how faculty can adopt teaching methods and techniques to accommodate varied learning styles of this new student clientele. In Chapter Seven, Claire Rolnik in collaboration with Ana Hnat discusses what faculty should know if they are to be effective in teaching composition to limited English proficient (LEP) college students. The authors show the complexity involved in learning a new language which ESL students must face. The chapter s major objective is to make mainstream developmental education program featured collaborative work through learning communities that provided social support and a comprehensive curriculum to teach students word processing skills to ensure progression from developmental studies to regular program (Adams & Huneycutt, 1998). Santa Fe Community College employed student-centered learning strategies when it adopted a technology support system with e-mail communications to keep students on task (Tyree & Smittle, 1998). Student-centered learning at Trident Technical College is provided through flexible learning options (i.e., developmental math courses via distance learning and broadcast services; Thornley & Clark, 1998). The developmental studies program at Grambling State University has used multimedia strategies for mathematics and study skills through computer tutorials and videotape broadcasts over closed campus cable television learning channel television (Barnes 1997, 1995).

Summary

The global economy has caused the winds of change to sweep through the nation and dramatically change the required skills needed for 21st Century jobs. These changes have rippled through postsecondary education and are constantly restructuring the teaching and learning environment. This new technology-driven environment is learner-centered and requires learners, faculty, staff, and administrators embrace technology. Developmental educators are have long recognized the that "improving learning should be our destination (Milliron & Miles, 2000, p. 39)"; however, developmental educators must now recognize that "information technology [is] our welcome companion along the path" (Milliron & Miles, 2000, p. 39).

CHAPTER 6

Using Relevant Pedagogy: Recognizing Student Diversity to Enrich Learning Science in the College Classroom

Marilyn M. Irving and Leon A. Dickson, Jr.

This chapter examines the current higher education crisis around issues relevant to diversity. The authors will present ideas on using relevant pedagogy to enrich the learning of science by a diverse population of students. The authors will also provide suggestions for how teachers may adapt teaching methods to accommodate varied learning styles.

Over the past 20 years calls for changes in teaching and learning have repeatedly gone out so that all students can more actively learn science (O'Loughlin, 1992; Shymansky & Kyle, 1992). Outside of the research community, more than 400 national reports published by various citizen groups, sponsored panels, commissions, and committees during the 1980s and 1990s have joined in this call (Hurd, 1994). The perception that America's students are inadequately prepared for the global economy has evoked a national effort to establish goals that would enhance the performance of this country's educational system (National Educational Goals Panel, 1992). Most experts agree that U.S. minorities are underprepared and underserved in science and mathematics (National Center for Education Statistics, 1990; Oakes, 1990; Shakhashiri, 1990; Suter, 1992). African American and Hispanic American students in particular have been shown to take fewer mathematics and science courses in high school and have lower grades in those courses than their European American or Asian American counterparts (National

Center for Educational Statistics, 1990; Orfield, 1989; Suter, 1992). The influx of new technology in the workplace increases the demand for higher levels of minority student participation and achievement in science and mathematics (Johnston & Packer 1987; Oakes, 1990). Thus, for both ethical and practical reasons, it is incumbent upon the nation's educational systems to focus on developing the science and mathematics potential of these currently untapped populations.

An increased awareness of diversity has generated discussion and change in many disciplines, especially mathematics and science. As public school populations become more ethnically, linguistically, and economically diverse, the issue of increasing the number of culturally and linguistically diverse educators gains more importance. We need to develop new leaders of color in a nation where the population is growing both older and more diverse. Supporting diversity in every area of American society is essential to the intellectual development of society. To be diverse is to be inclusive.

Without a doubt the United States critically needs dedicated and well-prepared ethnic minority science teachers. The changing demographics of the student population means many ethnic minority students need to see role models in science and science teaching (Loving & Marshall, 1997). In addition, however, our nation urgently needs teachers who can effectively instruct students from a variety of backgrounds in urban, rural and suburban settings. Existing science curricula should be "made more" versatile and ready to meet the challenge of diversity in schools (Irving & Dickson, 1999b). In the interim, professional development programs designed to enhance both the content knowledge and the pedagogical skills of current science teachers should be established (Carnegie Commission on Science, Technology, and Government, 1991; Cooper, 1999; Committee on Education and Human Resources, 1994; U.S. Department of Labor, 1992; Van Zee, 1998). Educating all students requires that teachers gain new knowledge and skills, along with a greater ability to reflect on their students' current knowledge, and an awareness of how to expand that knowledge (Darling–Hammond, Wise, & Klein, 1995). Rather than merely covering the curriculum, however, teachers

need to be shown ways to support and connect with the needs of all learners. To meet the increasingly demanding goals of science education, professional development programs must provide teachers with guidance in implementing the instructional methods that best reflect advances in science content and pedagogy (Branscomb, 1993). To be deemed successful, these programs must help teachers gain more than a basic awareness of a particular curriculum or teaching strategy; they must provide teachers with the capacity to transfer the information from the training program to the classroom (Joyce & Showers, 1988).

Most science curricula lack the essential elements for teaching in a diverse setting. Some of the essential elements for teaching in a diverse setting include providing for role models and mentors from underrepresented groups, incorporating cooperative learning, placing emphasis on challenging work and study habits, using culturally relevant materials, and allowing students to perform science tasks related to everyday life. For example, a close examination of the literature reveals that some science teachers lack a clear understanding of the elements of multicultural education (Irving & Dickson, 1999b). A widely held assumption is that if teachers are provided with innovative curricula and shown how to use them, they will implement those curricula and methods in their classrooms (Joyce & Showers, 1988). However, to teach conceptually, an instructor needs a conceptual understanding. Given that many of today's teachers were themselves taught science through ineffective traditional methods, their understanding of science subject matter may be deficient (McEwan & Bull, 1991). Moreover, teachers who do not have a strong content knowledge base tend to teach didactically, relying on "expert" sources such as textbooks and content lectures to transmit information to their students (Stofflett & Stoddart, 1994). These teachers trust neither themselves nor their students to construct an understanding of science concepts. If members of minorities who have been underrepresented in science begin to enter science education in greater numbers, they will not only serve as role models for students, but also provide guidance to fellow educators of all origins (Loving & Marshall, 1997).

For mathematics and science to reach more students, curricular and pedagogical changes must occur as well as changes in teachers' behavior. Changes in curriculum and pedagogy are long overdue and are clearly necessary if better-prepared teachers are to teach effectively across diverse cultures (Carrell, 1997). Teacher education programs struggle to ensure that preservice educators have the essential skills to intervene effectively in the learning and behavioral characteristics of students from diverse backgrounds. In spite of culturally relevant pedagogy and the diverse field experiences of preservice educators, these educators tend to hold their relatively unchanged original beliefs and attitudes.

Educators are turning to new approaches and resources to address the varied backgrounds and educational needs of students. Some of the approaches held by educators include high academic and personal expectations for each child they teach. They hold firm to the belief that every child can learn and should be able to develop to the maximum level of his/her potential (Darling-Hammond, 2000). As classrooms become more diverse, a diverse teaching force of competent, caring, and skilled individuals is needed to communicate effectively with students from many racial and ethnic backgrounds (Talbert-Johnson & Beran, 1999). Teaching from a diverse perspective enables students to recognize the important contributions made by people from cultures both different and similar to their own. By bringing an awareness of learning methods into the teaching of science (i.e., learning styles, auditory, visual, hands-on, written, graphic, prior knowledge, and experiences) educators can create a learning environment in which students see their heritage recognized in the classroom. Using a participatory approach can help students perceive their own connection to science and become more confident in their own abilities to do mathematics and science and while developing a greater understanding of other cultures. To do this, teachers must have a basic understanding and respect for different cultures. If science is taught from a multicultural perspective, students can learn to see the differences among people. Different students will achieve understanding in different ways, and the depth and breadth of students' understandings will

depend on the students' interest, abilities, and context (Vasquez, 1998). Not only do students need time to pursue a variety of activities leading to learning with understanding, but the activities in which they engage will have potential relevance to their lives and will be perceived by them as important.

Students learn better in an equitable environment. An equitable environment offers all students the opportunity to participate in inquiry-based science investigations. Many culturally responsive educators provide equitable access to the necessary learning resources and sufficient opportunities to learn for each child. It is important and necessary to build the foundation so that each child can learn, it is critical that educators know "where their students are" in their knowledge and skills and that they are able to provide the correct "next steps" so that students can effectively learn in all areas (Irvine & Armento, 2001). Research from the cognitive sciences and from science education has transformed our understanding of how children learn. While in the past, students were seen as passively absorbing knowledge, now the view has shifted to the "constructivist approach" in which students are seen as constructing knowledge by interpreting and understanding new content, and meaningfully linking that new content to their previously existing knowledge (Resnick & Chi, 1988).

The diversity of students is recognized when the facilitation of their growth is made by academic adaptations that match and build upon the their prior knowledge, experiences, skills, and beliefs (Au, 1993). This is an important aspect of enabling students to succeed. When educators have some idea of what students are thinking, what they know, what misconceptions they hold, teachers can be able to make appropriate teaching and learning adaptations. Being able to make academic adaptations means that the teacher is able to diagnose learner's strengths and weaknesses and then is able to figure out what to do next to prompt learning.

Science education stresses the role of prior knowledge and experiences in new learning (AAAS, 1993; NRC, 1996). Scientific understanding requires that students construct knowledge by integrating new information into their prior knowledge and make meaning of the newly constructed knowledge (Driver, Asoko, Leach, Mortimer, & Scott, 1994). Teachers especially need to understand the prior knowledge of students from diverse backgrounds who may have alternative conceptions that differ from the mainstream notions (Barba, 1993; Matthews & Smith, 1994). Some students may have had little, if any, previous experiences with science topics in the U.S. science curriculum (Atwater, 1994; Lee, Fradd, & Sutman, 1995). The studies mentioned here emphasize the importance of incorporating in the curriculum culturally relevant and familiar examples, analogies, and contexts. In this way, teachers will help students use their alternative ways of making sense to develop scientific conceptions. One of these alternative ways of sense making that help students learn is hands-on, inquiry-based science instruction. In hands-on science instruction the teacher engages the students in questions that require them to think about and apply what they are doing to new situations. A corollary of hands-on instruction is "minds-on" instruction which involves dialogue and discussion as students explore hands-on materials. Experiences with particular science phenomena must be concrete, relevant to students' lives, and varied (National Science Resources Center, 1988).

Using examples from everyday experience, teachers provide students with opportunities to explore scientific phenomena. The students explore scientific ideas by "playing" with materials and openly discussing what they observe with others. Through this exploration students apply their naive understandings to the material and develop explanations for the failure of the material to comply with their previous understandings. This experimenting also gives students an opportunity to confront their misunderstandings and develop new understandings (Kober, 1993).

The present authors stress using culturally familiar analogies whenever possible in order to connect concepts taught with students' real-world experiences. When learning outcomes are meaningful, relevant, useful, and important to each child, learning is ensured. By knowing and understanding students, personal and relevant examples can be used to illustrate content ideas (Ladson-Billings, 1994; Nieto, 2000). There are many connections and

applications for any area of learning, so students and teachers should become familiar with thinking about "how" this learning relates to their lives. If students see no relevance for studying biology, for example, it will be difficult for them to persist and to select another advanced science course. Multiple means of representing knowledge help the students to participate fully. Teachers must be able to select curricular content and instructional strategies that support, engage, and address this diversity of knowledge. Educators must be encouraged to reflect upon how they view themselves and others and must be challenged to think in broader ways. Learning is interactive and occurs in a social context that broadens students' knowledge base. The goal is to transform the classroom into a learning environment where ideas are shared, evidence is used to strengthen ideas, and ideas are willingly changed through exploration, dialogue, and discourse (Kober, 1993).

Providing learning-support communities for each student (families, peers, homework hotlines, community centers) can nurture their learning. Families can play important roles in helping students see the value of education. They also can support learning by monitoring homework, assisting with and checking homework. Instructional strategies, such as cooperative learning, provide a more appropriate cultural match between instructional styles and learning for some minority students and result in improved learning. Using interactional patterns commonly found in the African American church, such as choral and responsive readings, might be especially culturally relevant. Use of effective questioning techniques and higher order questions are important because they promote the development of analytical and evaluative thinking skills, they affirm the students' self-perceptions as learners, and they allow students to see themselves as knowledge producers rather that knowledge consumers (Jackson, 1994).

Diversity enriches the educational experience. Both teachers and students can learn from experiences, beliefs, and perspectives that are different from their own. Diversity challenges stereotyped perspectives, encourages critical thinking, and helps students learn to communicate effectively with people from varied backgrounds (American Council on Education, 1998). The key emphasis in recent science education reform involves inquiry or "doing science." To make sense of the world around them, students engage in scientific inquiry by formulating questions, proposing hypotheses, manipulating materials, describing objects and events, experimenting with variables, gathering data, verifying evidence, making inferences, constructing explanations, and drawing conclusions.

Addressing the question of how to teach science is central to any science teacher education program. By understanding the process of learning science, teachers can develop a model in which all students become active participants in the development of their own theoretical frameworks (Irving & Dickson, 1999a). Teachers will further enhance their relationship with students if they include verbal (e.g. use of the other person's name, praise of others' ideas) and nonverbal reinforcement (e.g., use of eye contact, physical closeness, smiling) (DeVito, 1998).

Research indicates that student performance on proficiency tests will be unlikely to improve until educators examine their own instructional practices. National, state, and local goals and standards acknowledge that students learn in different ways (Trowbridge & Bybee, 1996). Unfortunately, while educators often work with students on a one-to-one basis or in small group labs, they continue to use their normal instructional strategies. Such efforts do not significantly change scores because using mismatched strategies to remediate students does not maximize students' learning potential. In other words, when teachers try to teach using the usual methods but using them more intensely by involving smaller numbers of students and longer sessions, they are not seeing effective results.

How individuals learn best is defined as their learning style (Dunn & Griggs, 1995). In schools that have demonstrated increased achievement gains among underachieving students, instruction has been matched to these students' learning preferences (Andrews, 1990; Quinn, 1994; Stone, 1992). More than 100 dissertations have documented increased student achievement when learning styles are identified and accommodated as students' process

new information (Thomson, Carnate, Frost, Maxwell, & Garcia-Barbosa, 1999).

The role of the teacher is essential to improved science instruction. Much can be learned from the successful, pedagogical practices of teachers in terms of successfully teaching science to all students. Teachers' attitudes, views, and experiences contribute to the development of their pedagogical practices. Some of these teachers' pedagogical goals include teaching their students rigorous academics as well as providing them with the knowledge necessary to equip them with the ability to pursue careers in science. In addition to endeavoring to create supportive classroom environments, some teachers strive to produce knowledge that uses, reproduces and increases students' performance in science. A culturally relevant pedagogy also includes a determination to incorporate students' home and community culture in the classroom.

It is important to note that, when speaking of a teaching philosophy or pedagogy in science, it is not to be implied that any one teaching philosophy or set of absolute components of teaching practice exists. Teaching philosophies and pedagogies embrace perspectives and practices that affirm the importance of science education and economic success and advancement of all children (Foster, 1990, 1993; Henry, 1992; Joint Center for Political Studies, 1989).

The teacher's role in the classroom has been changing. As has always been true, the teacher still needs to identify projects that will interest students, monitor their work, and help them learn how to work together (Trumbull, 1990). Today, however, the teacher's role has been transformed from primary dispenser of knowledge to facilitator of learning. This new role is more demanding in many ways and requires much skill and effort. Now the teacher works within the context of a rich learning environment, in which the student is an active learner. Rather than telling students what they are to learn, the teacher sets up an environment in which students can actively acquire knowledge, mainly through experimentation and discourse (Trumbull, 1990).

Dedicated teachers have held themselves responsible and accountable for the educational achievement of the children attending their schools (Franklin, 1990; Neverdon-Morton, 1989) and have valued education as a method to achieve individual enrichment as well as social progress (Weiler, 1990). When teachers have high expectations for students, the likelihood for them to succeed is markedly increased.

It is critical for educators to look at their own practices when working with students who are underachieving learners from diverse backgrounds. Because students are generally taught using only a few instructional strategies, underachieving students often believe they are not competent. Students who are asked to process new and difficult information day after day, year after year using styles that do not match their own culture create their own culture of failure and low self esteem (Brunner & Majewski, 1990).

Teachers, who for example use culturally familiar analogies whenever possible, connect science concepts to the students' real-world experiences. Occasionally bringing culturally familiar examples into the science classroom makes the learning environment hospitable for all students. Hands-on learning also allows students to structure information in their primary language. When knowledge is represented in many ways, more students will learn. Teachers can present students with the actual object, the spoken and written language, models, and line drawings. These multiple representatives of knowledge allow students the opportunity to form schema in one mode or the other or both. Science becomes more real and meaningful to them because the representation includes them in science. Culturally based representations help students relate to important figures of their culture who have made scientific contributions.

A few of the significant elements that enhance diversity include teacher development, instructional approaches, nontraditional assessments, scientific literacy, partnerships, and pedagogy. **Teacher Development:** Develop teachers with strong content and pedagogical foundations in mathematics and science, thereby enabling them to make real world applications and connections. All of these principles depend on the professional development of teachers. Good professional development leads

to exemplary teachers who, in partnership with others in the school and community, have a good command of their subject matter and have the pedagogical skills to create productive learning environments for diverse populations of students. **Instructional Approaches:** Teachers and their districts administrators need to develop and implement curricula, which are application based, are interdisciplinary, and require active learner participation. Students should learn science by doing science rather than by reading about it. Visual aids, such as pictures, models, drawings, and actual objects, enhance oral or verbal instruction. Displaying scientific concepts along with descriptive pictures in the classroom, or using realia, effectively reinforces the presented concepts. A large vocabulary is not essential for understanding scientific processes or for developing an awareness of the interconnectedness of scientific concepts if understanding is based on active learning. **Non-traditional Assessment:** Innovative assessment techniques reflect curricular goals and instructional strategies appropriate to mathematics and science. They also allow students to express their understanding in different ways. **Achieving Scientific Literacy:** Fundamental changes in the state educational structure can push students, teachers, parents, administrators, and the community toward valuing scientific understanding. **Partnerships:** All students need to see adults from different backgrounds as scientists. School partnerships with local industries and higher education are one way to achieve this. Community members can be invited to present their specialties to classes or to mentor specific students (Darling-Hammond, Wise, & Klein, 1995). School administrators have begun to respond to this need by providing inservice workshops on teaching diverse student populations. Too often, however, these workshops prove ineffective. Sleeter's (1990) analysis of multicultural workshops focused on awareness or sensitivity training and on enhancing intercultural understanding and recognizing laudable goals, yet teachers continue to say "OK, I now know how students differ from each other, but how can I change my delivery of instruction to address these differences?" **Equity and Diversity:** Exemplary teacher educators and teachers understand the cultural values and norms of behavior of their students. They use knowledge of these values and norms to construct a positive learning environment for each of their students. In addition, they help their students recognize and overcome the stereotypes about particular groups that exist in mathematics and science. It is also critical that nonmainstream and mainstream students see adults representing diverse populations in the school. **Pedagogy:** Mastery of K-12 mathematics and science pedagogy enables teachers to transform content knowledge into powerful and productive learning experiences appropriate for diverse groups of students. Learning to transform content into such learning experiences requires the support of arts and sciences faculty and teacher educators in college classrooms and in the unique world of K-12 classrooms.

Good teaching is good teaching is good teaching. . . All students find science exciting and relevant when it is taught as an active rather than a passive process (Ladson-Billings, 1995). When students can relate what they are learning to their everyday lives; they begin to own the subject. As science teachers, we must always be aware of the needs of our individual students and see that these needs are reflected in our curriculum.

CHAPTER 7

Preparing College Faculty to Understand the Writing Limitations of ESL Students

Claire Y. Rolnik in collaboration with Ana Hnat

Teaching in high schools and colleges is strenuous work, especially when classes are large and more so, when some students are not native speakers and often require more time for paper corrections. As a result, ESL (English as a Second Language) students are often not dealt with appropriately by mainstream teachers. Whether intentionally or inadvertently, they are often considered underachievers because of their imperfect English. Dr. Sandra Prager (2000) points out that "Ignorance and/or resistance to the concerns of a special population of students is commonplace, to say the least." The reason for this attitude could most likely be attributed to the fact that the English language has become so important. Since it has slowly become the international language in practically all the world, Americans generally feel self-sufficient speaking one language. They therefore cannot empathize as easily with foreign students struggling with the English language, for in many cases they themselves have not found it necessary to make this kind of effort. As a result of this, negative attitudes sometimes lead to poor decisions that have a detrimental influence on ESL students. Such a situation hinders a positive educational atmosphere. This negative situation could be improved if mainstream teachers could understand how complex the learning of a foreign language (in this case, the English language) can be to a non-native speaker. By understanding how much is involved in learning a new language and how the structure of a student's native language can interfere, we hope that there will be less resistance, frustration and accusations, and more understanding.

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Dear Drs. Irving and Dickson:

I am elated to inform you that *Teaching Culturally Diverse College Students in a Pluralistic Society* has been published by Wyndham Hall Press in its *Rhodes-Fulbright International Library* series.The chapter that you submitted entitled "Using Relevant Pedagogy: Recognizing Student Diversity to Enrich Learning Science in the College Classroom" is the sixth chapter in this publication. Because it is the tradition of Wyndham Hall Press to publish only the finest in scholarship and creative literature, this book has undergone thorough evaluation and careful consideration of its contents to ensure on-going maintenance of their tradition of excellence. Your contribution to this book project is greatly appreciated.

Please find enclosed your complimentary copy of *Teaching Culturally Diverse College Students in a Pluralistic Society.* If I can be of further assistance to you, please feel free to contact me at (318) 274-6063/7374. Thanks for your cooperation in this scholarly accomplishment.

Sincerely,

Vernon L. Farmer

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CHAPTER 14

Preparing Teachers To Work With Diverse Student Populations

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This chapter focuses on some of the responsibilities schools, colleges, and departments of education must assume to prepare all teachers to teach and work with diverse student populations. Given changes in the demographic composition of the teaching force in the next decade, this chapter addresses some fundamental recommendations for revising the curriculum and structure of pre-service teacher education programs so that all teachers will be able to teach every child in any situation.

The student population of today's schools reflects widely diverse socioeconomic, linguistic, and ethnic backgrounds, yet few teacher training programs are currently addressing the need to recruit and train teachers reflecting this diversity. Academic preparation at the undergraduate and graduate level is critical that teachers be exposed to a wide variety of liberal arts and education courses during their undergraduate and graduate training. It is important that teachers are trained well because after all they must impart substantive knowledge to elementary and secondary students. Such knowledge has been mastered by prospective teachers; they are then ready to link theory to practice when they begin to teach.

When becoming familiar with specific foundations and behavioral aspects of teaching, they also become familiar with a variety of methodological techniques. They must also be award that teaching is also influenced be factors such as racial and cultural backgrounds, the ability and motivational levels of the students, the setting of the school (for example, rural, urban, or suburban), adequacy of instructional resources (for example, textbooks, equipment, laboratories, and so on), class size, and so on. For those reasons, the professional preparation of pre-service teachers must include additional academic knowledge related to diversity and diverse contexts that can be incorporated into their professional education curricula and clinical experiences. Being aware of that knowledge, novice teachers will be better equipped to successfully teach children who come from culturally, racially, and socio-economically diverse backgrounds.

Because of the challenges created by adverse social and economic conditions in the world today, tomorrows cohort of teachers will need to be more proficient in many more skills than

are teachers who were trained over the last two decades. More children--particularly in public schools--come from poorer backgrounds. Because of smaller budgets in most school districts, class size is larger today, which places greater responsibilities on teachers who must work with limited resources. Teachers of the future will have to be creative and resourceful educational leaders who are independent thinkers, who can successfully implement instructional practices.

Besides being knowledgeable in many content areas, future teachers must also become more competent in a variety of methodological techniques so that they can adapt and modify those skills to meet the individual needs of their students. These teachers must also be flexible and knowledgeable enough to use alternative instructional practices when their students are not achieving successfully. Teachers of today's culturally diverse classrooms must know how to plan and organize effective instructional situations, how to motivate students and manage their classrooms, and how to motivate students, in addition to being competent in the assessment of the academic strengths and weaknesses of all children; and learn how to encourage the cooperation of their students' families and communities in the conduct of their daily responsibilities (Garibaldi, 1991).

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One of the areas to which pre-service teaches need more exposure to is the cultural differences that exist between and among students. This is an important dimension since a great deal of research over the last decade has shown that children from culturally diverse backgrounds do indeed exhibit learning differences and that other factors such as parental support, encouragement, and feedback positively affect their motivation, aspirations, and achievement (Boykin, 1979; Hale-Benson, 1986- Clark, 1983- Oakes, 1985; Willis 1999).

Teachers of culturally different children, therefore, must recognize that learning distinctions are prevalent and that environmental influences can mediate academic success. A variety of techniques have been used in schools, college and departments of education to increase education majors' awareness of and sensitivity toward students of different racial, cultural and ethnic backgrounds.

To be effective educators, teachers must be highly competent in planning and organizing instruction as well as in managing the classroom environment if their students are to be academically successful. Some of these management skills are learned in methods courses, others are developed in educational psychology and social foundations of education courses, and still other expertise is derived from exposure to classroom situations in schools through clinical and practical experiences.

Recognition and understanding of contextual factors are extremely important in successful teaching practices, and those factors influence the planning and organization of instruction. An inter-organizational report of the American Association of Colleges for Teacher Education, the American Federation of Teachers, the National Council on Measurement in Education, and the National Education Association identifies four key skills that teachers must possess prior to engaging in instruction: "understanding students' cultural backgrounds, interests, skills, and abilities as they apply across a range of learning domains and/or subject areas; understanding students' motivations and their interests in specific class content; clarifying and articulating the performance outcomes expected of pupils; and planning instruction for individuals or groups of students" *(Standards for Teacher Competence in the Educational Assessment of students, 1989, p. 2).*

Pre-service teachers must, therefore, be trained to employ approaches and modalities that accommodate the distinctive learning styles of students from different racial and cultural groups. While traditional approaches may be useful in some settings, teachers must be able to adapt or select the pedagogy that is most appropriate. Research on cooperative learning practices indicates that students achieve more when working in groups rather than working individually or in competitive situations (Johnson and Johnson 1989).

The teacher who bases lesson planning on his or her desired educational goals and objectives, who is highly organized, and who varies learning strategies, has very few classroom discipline problems. As Boykin (1979) has noted, schools need not be "unstimulating, constraining, and monotonous" places where children are usually bored; thus, teachers must channel students' high energy levels into productive, task-oriented activities. Teacher education students receive very little applied training in motivational techniques.

Although human relations classes have been incorporated into many teacher education programs since the early 1970s, in addition to in-service cultural and racial awareness seminars for novice and veteran teachers in school districts, the best way for teachers to learn about their diverse students is through real situations (Goodwin, 1990). Education majors, therefore, must be exposed to a variety of students and schools as early as their first semester of pre-service education. They should be assigned to different schools and classrooms every semester of their four- or five-year programs so that they can both observe and participate in the daily activities of teachers in varied school situations. Moreover, students n methods courses should be required to tutor and to perform micro teaching classrooms and schools so that they can "reality test" the suitability of particular instructional approaches with children of exceptional, average, and below-average abilities.

Teacher education majors, therefore, should be required to have a minimum of twenty hours of combined one-on-one tutoring, group or classroom instruction, and specific methods courses so that they can practice teaching content to students while simultaneously applying varied instructional techniques.

Teacher education programs must also devote more attention to the important roles that the home, parents, and community play in the effective education of children, especially those who come from urban cities and rural communities. Novice teachers must be trained how to communicate better and work more closely with the parents of their students.

Teacher education programs must be restructured to accommodate the diverse teaming and cultural styles of elementary and secondary school populations. This goal cannot be accomplished with one course focusing on multicultural populations, through orientation and in- service seminars, or through a single field experience in an urban or rural school. A holistic approach to teacher training must be developed that recognizes the strengths in diverse student populations rather than placing emphasis on cultural-deficit models to explain low performance by children of particular backgrounds. Teachers must also take into consideration the context of the school and the diversity of their students in planning and organizing instruction and use pedagogical techniques that are most appropriate for the grade and subject matter that is being taught.

Teachers must also learn more about classroom management, and motivational techniques during their pre-service years so that children can develop appropriate social skills and personal confidence, in addition to their academic talents. Teachers must be afforded more opportunities to practice these skills, and in varied settings, through more clinical experiences throughout their undergraduate and graduate training. Finally, students who will teach must learn how to communicate more closely with the parents of their children, to motivate, encourage, and reward children's academic performance.

In conclusion, prospective teachers must be trained to believe that all children, regardless of race and social class, can learn and succeed. All teachers, regardless of their own racial or ethnic backgrounds, must realize the important role they can play in shaping students' career aspirations, their academic and personal expectations. Teacher training institutions must prepare for an American educational system whose population will be thoroughly diverse by the year 2000.

Education leaders must focus research attention on the problems of schools with diverse student population and develop appropriate programs to prepare teachers for these schools. Possible solutions include such techniques as forming dynamic partnerships among universities, public schools, businesses, parent groups, and social service agencies; implementing policies and procedures that ensure racial and cultural fairness; and making bilingual education services readily available.

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ESSAY 21

Mentoring in the Advising Process

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The best advice that I can give on how to succeed in graduate and professional school and in your career field is to recommend that the graduate student find a mentor. First-time graduate students entering the academic environment are much like freshmen entering college for the first time: hesitant, skeptical, and in need of someone to guide them through the rigors of academic work. Whether the student is studying for faculty positions, professional endeavors, or simply to better his or her educational framework, the common needs held by all graduate students include a mentor for guidance through difficult stages and academic challenges.

The concept of mentoring has found application in essentially every forum of learning. In academics, mentoring is a personal as well as professional relationship. Mentors are advisers, people with career experiences willing to share their knowledge and specific feedback on the graduate student's performance. Good mentors are able to share life experiences and wisdom as well as technical expertise. They are good listeners, good observers, and good problem solvers. They make an effort to know, accept, and respect the goals and interests of the graduate student. A good mentor is a good role model through both words and actions. They can discuss with students the special features and satisfactions of their own position, being frank about its advantages and drawbacks. They can be constructive and provide critical feedback, which is essential to stimulate improvement and praise when deserved.

Mentoring and networking provide the support system and environment, which help graduate students to develop and grow professionally and personally. A mentor is someone who has had personal success in that role and

whose experience in given areas or disciplines allows them to offer insights guidance, and assistance within the institution. The mentor can be instru mental in providing guidance to the graduate student in career aspiration and educational objectives as well as personal guidance.

Mentoring relationships are important for all individuals pursuing a de gree or a career. Particularly for graduate students, positive mentoring rela tionships can set up a path of success. Although there is not a define method of pairing a graduate student with a mentor who will guide an mold the student in different areas, there is at least agreement that the rela tionship is significant and important. Aside from providing the opportunit to share talents, the relationship also provides mentors with a sense of use fulness and importance.

Graduate students entering the world of academia, no matter how long o for what purpose, can use assistance and guidance from a seasoned profes sional. As students, they must maintain the energy and motivation to excel being associated with a mentor can enhance their chances to rise to promi nence. I strongly suggest that all graduate students find a mentor since he o she can have a powerful impact on one's success in school and in one's caree

Mentors can inform about and recommend activities in which graduate stu dents should become involved. Mentors will enthusiastically write recommen dation letters for them and continue to follow them throughout their caree The guidance, direction, and tutelage that mentors can provide can lead to suc cess in graduate school and in the student's professional life. They can encour age students to explore many options. In addition, mentors can introduc students to members of their own network of contacts, recommend searc aids, including Internet sources; professional societies; and ads in journals an major newspapers. Mentors can also help graduate students prepare for job by helping them to sharpen the skills needed, design a good curriculum vita rehearse interviews, learn about the current job market, and advise students t join and take a leadership role in disciplinary societies and journal clubs.

Having a comfortable relationship with a mentor allows graduate stu dents to be able to discuss the long-term benefits of their work, prope course sequencing, available job identification services, and conferences an seminars they should attend. A mentor can be instrumental in introducin them to proposal writing, to subscribing to journals in their area, and to get ting them excited about attending conferences in their field of study.

Mentors can have high expectations for graduate students that can inspir them to overcome their struggles and achieve their goals. They can challeng students and stimulate them to learn their subject well enough to success fully compete in their chosen professional area. When mentors appropri ately congratulate graduate students for worthwhile accomplishments o model behavior, it does make a difference. Positive reinforcement, whe given, is a significant component for graduate students on their "road t success" agenda.

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The Black Student's Guide to Graduate and Professional School Succe dedicated to my son, Vernyatta L. Farmer, and all other Black students seek to embrace their heritage, hoping that they will strive in all aspec develop their fullest intellectual capacity and that they will be inspired t plore the true heritage of their own people. I hope that they will realize education is essential if they are to claim their rightful place in this na and the world. For this reason, Black people have always stressed ed tional achievement at all levels of the learning continuum, and through severance, sacrifice, faith, and struggle they have managed to remove m of the educational barriers that stood in their way. Black students must derstand that life is what they make it. Struggling is the real meaning of success and failure are in the hands of God. Shun not the struggle becau is God's gift. Therefore, obtaining a graduate and/or professional degree major step that Black students must take in making this claim.

Black students, you must understand that education is the great equal that will give you the power to balance the scale of inequality. However, must also be cognizant of the great achievements of Black people who tr eled the road before you and who paved the way for you to obtain an e cation. Your recognition of the past experiences and contributions of Bl people to the nation and the world will strengthen your pride and self-este and provide you with the tenacity to achieve even more than they achiev May you continue the struggle for a graduate education and for the po that knowledge manifests, and may you draw inspiration from the pas sense of understanding from the present, and hope from the future. Bl students, as you witness the beginning of the new millennium, you find yo self part of a proud tradition, walking in the footsteps of your ancestors blazing a path for those yet to follow. In this sense, the struggle toward eq ity for Black people in the world reaches backward as it strains forward.

Finally, you must never forget where you came from, what made it po ble for you to get to where you are today, and what it will take to get where you want to be in the future. You must never forget that God, whatever name you choose to call the Omnipotent, has been and rema the one essential fact that has guided Black people in their struggle equality in the world. Finally, you must recognize the privilege, seize the portunity, fulfill the responsibility of learning, and become commit workers in the daunting task of making a new world, contributing to improvement of Black people and the nation.

One of the promises of our participation in the political system through the civil rights movement was that our view would be fairly reflected in the political system through men and women who respected that tradition and that legacy. The respect for this legacy is due because it was purchased at the price of personal and collective insult and injury that was meted out solely because of race. Leon Higginbotham was of the generation that experienced such insults directly. He often spoke of the difficulties that he faced while an undergraduate at Purdue University, as a student at Yale law, trying to get a job as a lawyer, in the practice of law—in short, at every step of his development. The experienced men and women of his generation fueled their strong determination to end racism by joining the collective efforts by a variety of groups fighting it.

While Leon Higginbotham Jr. was insulated from direct involvement in the Civil Rights Movement during most of the 60s and 70s as a sitting federal judge, he nonetheless mentored some of the most accomplished civil rights lawyers today.

He went to great lengths to try to call Supreme Court Justice Clarence Thomas to historical accountability. One of his most cited works is his "Open letter to Judge Clarence Thomas from a Federal Judicial Colleague." In this legal memorandum framed as letter, he attempted to remind Justice Thomas of his legal legacy. Thus, he wrote: "While much has been said about your admirable determination to overcome terrible obstacles, it is also important to remember how you arrived where you are now, because you didn't get there by yourself."

So I as many other Americans, Black and White are saddened by the fact that this Titan of the law and champion of the oppressed will no longer be among us. His passing depletes the ranks of those who are uncompromising in their use of the law to oppose racist practices in society. And it does not appear that the avocation of civil rights law is as attractive to the younger generation. As such, the ranks of civil rights law advocates are not receiving the replenishment that is needed to continue to fight against both old and modern racism. There needs to be a fitting memorial to Judge A. Leon Higginbotham Jr. that would insure that the ranks of those trained and committed to civil rights law will continue to grow.

In this, the need for civil rights lawyers is not merely an American avocation related to Blacks. Almost anywhere in the world one travels as an African American, he or she is aware that the world respects the monumental struggle that we have waged for human rights. We should build on this legacy—both domestically and, increasingly, as a part of the global community where the need for human rights is urgent and critical. I believe that this would help to continue to move his community forward—even in his absence.

Dr. Ronald Walters
Professor of Political Science, University of Maryland
Reprinted from *Black Issues in Higher Education* 15(23), 120, January 7, 1999

Acknowledgments

I have had a long-standing commitment and interest in increasing opportı nities for Black students to obtain a graduate education. Therefore, it wa with enthusiasm that I undertook the task of editing *The Black Student Guide to Graduate and Professional School Success*. I am greatly indebte to many individuals for their advice, encouragement, and support durin the various phases of this research project. A very special debt of gratitud is owed to the sixty-two distinguished scholars, including sixty Blacks, on Native American, and one White American, who wrote chapters and essay for this book. I also owe a great deal of gratitude to the twenty-seven Black students who wrote essays about their personal trials and triumphs in pursuit of their graduate and professional degrees. It is truly the stories that these students describe in their essays that help bring this book to life.

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Introduction

This book is the product of the editor's commitment to increasing opportunities for Blacks in graduate education. *The Black Student's Guide to Graduate and Professional School Success* is an informative book designed and written specifically for Black students to help them structure graduate and professional careers. The book provides background information critical to helping Black students make informed decisions about graduate education. In addition, the book guides them through the process of preparing for standardized tests; negotiating admission; finding a faculty mentor; choosing the right field of study; selecting the best curriculum; obtaining teaching, administrative, and research assistantships and internships; adjusting to the campus environment; adjusting to technology; engaging in research and publishing; developing a global identity; maintaining Black pride and self-esteem; interacting with other racial and ethnic groups; and focusing on the overall importance of graduate education. The book draws Black students' attention to the advantages and benefits as well as to the problems and roadblocks they may encounter enroute to a graduate and/or professional degree.

In laying the foundation for writing *The Black Student's Guide to Graduate and Professional School Success,* the editor and his research team examined hundreds of issues of Black publications, including *The Black Collegian, Black Enterprise, Black Excellence, Black Issues in Higher Education, Crisis, Ebony, Jet,* and the *Journal of Black Higher Education,* to identify Black authors from different types of higher education institutions and from varied professions and regions in the nation to make the book a nationally oriented publication. Evidence of exemplary research and publication, teaching and other creative work, community and public service,

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This is an invitation and a request for you to contribute an original entry(ies) to a proposed book now tentatively entitled, **The Black Student's Guide to Graduate and Professional School Success** (GM2311) edited by **Vernon L. Farmer**, to be published by Greenwood Publishing Group.

We feel that because of your particular interest, knowledge, and experience, your contribution to this work will be of great value, and we look forward to receiving your entry(ies), which we understand will be on the following topic(s): ***Please Fill in Topic(s):**
"Mentoring in the Advising Process"

If not previously done, your original contribution should be sent to **Vernon L. Farmer; Grambling State University; School of Graduate Studies/Research; PO Drawer 845; Garmbling LA 71245** on or before the time agreed upon with the Editor(s).

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For and on behalf of Greenwood Publishing Group, Inc.
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Wayne F. Smith,
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LT

The Black Student's Guide to

Graduate and Professional School Success

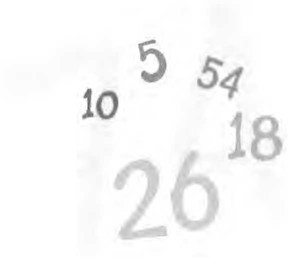
Edited by Vernon L. Farmer

Foreword by Carol Moseley-Braun

Selected Curriculum Developed

Dr. Marilyn Irving

Integrating Mathematics, Science, and Language Arts
with
Astronomy



Middle and Junior High School Teachers and Students

(Compiled by Middle and Junior High School Teachers)

District of Columbia Public Schools, Washington, DC

FY 2003-04 Teacher Quality Improvement Grant RFA # 1021-02

Marilyn M. Irving, Ed.D., Editor
Howard University
Washington, DC

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Table of Contents

Introduction

The mini booklet of astronomy activities has been created and successfully used by middle and junior high school teachers in the District of Columbia Public Schools, Washington, D.C. Each of the activities in the booklet is based on the following beliefs:

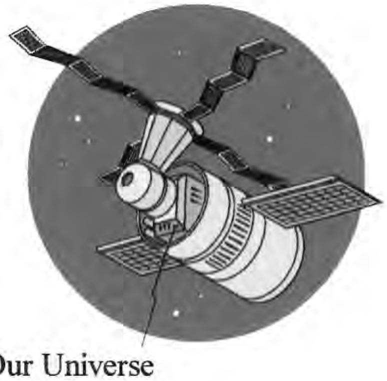
1. Student engagement is the key to learning.

2. Science is not an isolated subject; it can be integrated into other curriculum areas.

3. Astronomy education is crucial and necessary in order to understand our universe.

A variety of ideas and activities are included for teachers to use in teaching lessons on astronomy. The activities integrate mathematics, science and language arts in teaching the topic, astronomy. The lessons offer teachers ideas and materials that can be used in any ongoing and required curriculum.

Each lesson is set up with a title, introduction, essential question(s), knowledge and skills, evidence of understanding, a critical thinking prompt and a bibliography.



Title of Lesson: Exploring Our Universe

Introduction:
Students will develop an understanding of Earth and the solar system. Emphasis will be placed on the birth of modern astrology centering on the contribution of the ancient Greek philosophers. Overview of the constellation system for locating stars in the sky will be discussed. Activities, diagrams, and models on the primary motion of the Earth, the phases of the moon, lunar motion, and eclipses will be constructed.

Essential Questions:

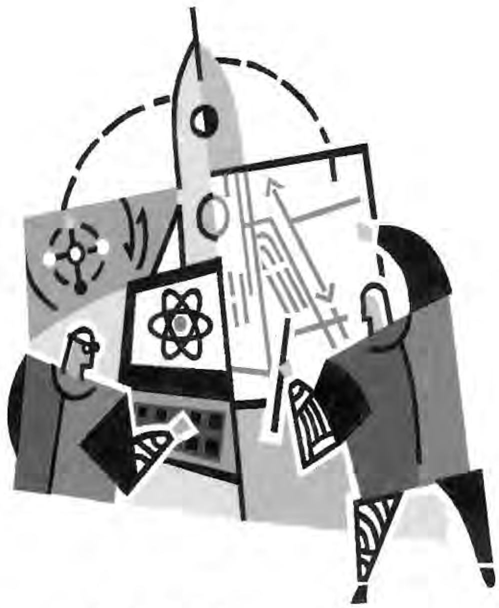
- What is the composition of our solar system?
- How would you explain the geocentric theory of the universe?

Knowledge and Skills:

1) Make models explaining the Ptolematic model of the universe for a better understanding of Earth and solar system
2) Make a model/diagram and explain the equatorial system of locating objects in the celestial sphere.
3) Create vocabulary list of terms related to the solar system
4) Construct a two to five paragraph essay discussing "The Primary Motion of the Earth"

Evidence of Understanding:
Students will be given a vocabulary quiz. They will also design a model of the solar system and explain the function of each part of the solar system.

Critical Thinking:
What do you think would happen if the statement were true that the earth is a sphere that stays motionless at the center of the universe? How is this possible or not possible? Why would this happen or not happen?



Title of Lesson: Investigating the Solar System

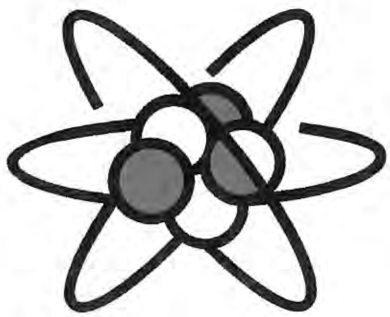
Introduction:
Students will have the opportunity to research, analyze, infer, and interpret as well as tour the solar system with a thorough investigation of the differences between terrestrial and jovians planets. An explanation will be given as to what is found in each planet. A complete inventory of the solar system will be conducted giving the features of each planet with explanation. A comparison of and the usefulness of different types of solar products will be explained.

Essential Questions:
- What are some of the general characteristics of the two planets (selected by students) in the solar system?
- What are some of the distinguishing features of each planet?

Knowledge and Skills:
1) Compose original lyrics, poems, and written expressions about the solar system using key terms learned in previous activity (Exploring Our Universe)
2) Construct a model of the moon and identify all of the lunar features.
3) Construct and identify all parts of a comet.
4) Read and examine different books on the solar system

Evidence of Understanding:
Students will submit a written report, create a mini book with colorful illustrations on the features of the selected planet, and create a solar clock.

Critical Thinking Questions:
Discuss how studying the solar system improves the quality of life for people on Earth. Why is the solar panel on a space shuttle important? Do you think that solar houses are the house of the future? Why or Why not? What about solar cars?



Title of Lesson: Phases of the Moon

Introduction:
The importance of the phases of the moon [new, crescent (waxing), first quarter, gibbous (waxing), full, gibbous (waning), third quarter, and crescent (waning)] will be introduced and explained. The cycle of the moon through its phases which requires 29 ½ days synodic month will be introduced to the students. The moon's revolution around Earth takes 27 ½ days sidereal month will be explained. The phases of the moon will be discussed, explained, and illustrated. Contributions made by scientists in the past will be discussed and compared.

Essential Questions:
- What makes the moon look different?
- Do the differences in the way the moon looks have anything to do with the phases?
- What method could be used to show the reason(s) for the differences of nearly two days in synodic month and sidereal month?

Knowledge and skill:
1) Predict the moon phases for one month
2) Create a chart that will show the predicted moon phases.

Evidence of Understanding:
Using the moon phase's chart (Appendix 1), students will fill in the phases of the moon. Students will explain the differences between a synodic month and a sidereal month. Students will use the calendar or almanac and notice the phases of the moon for the month at hand. Using the information at hand, students will be able to generate a chart that will predict the phases of the moon of the following month. Students will predict when an eclipse will occur.

Critical Thinking:
Discuss how an almanac was use for planting crops. Elaborate on what are almanacs used for today?

Title of Lesson: Moon Up, Moon Down

Introduction:
The focus of this activity will be on what happens when the moon moves in a line directly between Earth and the sun. Explanation will be given as to what is meant by the new moon phases. The new moon will be illustrated using diagrams. The phases of the moon, lunar motion, and eclipses will be explained and illustrated using different methodologies and teaching strategies. Students will be able to demonstrate using principles and natural laws of nature that keep the moon in orbit around the Earth.

Essential Questions:
- Why does the moon stay in its orbit?(Activity p.7)
- Why is the moon the Earth's natural satellite.

Knowledge and Skills:
1) Use principles and natural laws of nature to keep moon in orbit around the Earth.
2) Express opinions and ideas through teamwork as to why the Earth has one natural satellite, the moon.
3) Increase understanding of forces of mass and Newton's Second Law of Motion (F=ma)
4) Use technical tools such as the Internet to acquire information on the phases of the moon

Evidence of Understanding:
Students will be assessed using writing prompt for one-page journal reflecting activity. "The motion of the earth-moon system constantly changes the relative position of the sun, earth, and moon; the results are some of the most obvious astronomical phenomena, namely, the phase of the moon and the occasional eclipse of the sun and moon". Explain why the statement is true.

Critical Thinking:
If the moon left its orbit, what effect would it have on the planet Earth? On the entire solar system.

Activity: "Spinner"

Purpose: To demonstrate why the Moon stays in orbit.

Materials:

- Paper plate
- Scissors
- Marble

Procedure:

1. Cut the paper plate in half and use one side.
2. Place the marble on the cut edge of the plate.
3. Set the plate down on a table and slightly tilt it so that the marble moves quickly around the groove in the plate.

Results:
The marble leaves the plate and moves in a straight line away from the paper plate.

Why?
Objects move in a straight path unless some force pushes or pulls on them. The marble moved in a circular path while on the plate because the paper continued to push the marble towards the center of the plate. As soon as the paper ended, the marble traveled in a straight line. The Moon has a forward speed, and, like the marble, would move off in a straight line if the gravitational pull toward the Earth did not keep it in its circular path.

Title of Lesson: Planet Surface Temperatures

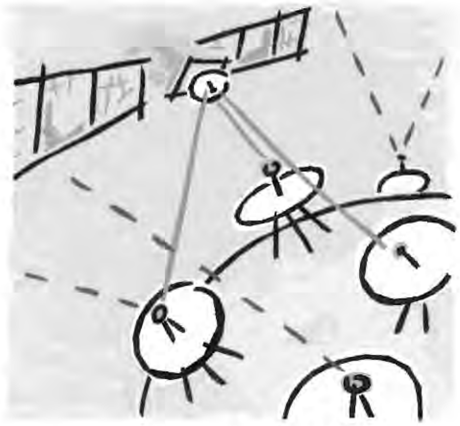
Introduction:
Student will learn that a planet's surface temperature is an important element of weather and climate because it greatly influences air pressure, wind and the amount of moisture in the air. The unequal heating that takes place over the surface Earth is what sets the atmosphere in motion, and the movement of air is what brings change in the weather. The single greatest cause for temperature variations over the surface is differences in the reception of solar radiation. The students will also understand why the daily maximum and minimum temperatures are the bases for much of the temperature data compiled by meteorologists. Students will learn how to calculate the daily mean temperature and the daily range of temperature.

Essential Question:
- Does temperatures remain constant from one area to another on a planet?
- Explain why or why not.

Knowledge and Skills:
1) Record the temperature in chart form for one week and calculate the daily mean temperature and daily range of temperature.
2) Convert the temperatures from Fahrenheit to Celsius.

Evidence of Understanding:
Students will write a one page paper explaining what happens to the solar radiation that is not reflected back to space.

Critical Thinking:
Explain why the geographic setting influence the temperature experienced at a particular locale. Why is cloud cover and Albedo of important?



Title: Search for a Habitable Planet

Introduction:
This lesson will define the life requirements of a variety of creatures and learn that these relate to measurable characteristics of planets the creatures might inhabit. Students will carefully examine tables of the planets, the terrestrial (Earthlike) planets and the Jovian (Jupiterlike) planet. The substances that compose both groups of planets are divided into three groups – gases, rocks and ices, based on their melting points. Students will research programs in the United States that are involved in the (SETI) search for extraterrestrial intelligence.

Essential Questions:
- Can other planets sustain life?
- What are at least two reasons why a planet can retain an atmosphere.
- What has rejuvenated the search for extraterrestrial life?
- Why is the planet Pluto true nature a mystery?

Knowledge and Skills:
1) Define creature life requirements.
2) Relate creature life requirements to planet characteristics.

Evidence of Understanding:
Students will be instructed to write a paragraph explaining why the planet they randomly selected will or will not be suitable for habitation. Design an experiment to show how you would search for habitable planets.

Critical Thinking:
Select a planet other than Earth and describe what adaptations a human would have to make in order to live there. If water is found on a planet is it possible for some form of life to exist? Explain your answer.

Activity: Habitability and Design Creatures

Vocabulary: habitable, life requirements, planet characteristics, surface and atmospheric composition (chemical examples)

Time required One to two 45-minute class periods.

Materials:
Requirements and Characteristics (Appendix 2)
Creatures' Cards (Appendix 3)
Solar System Images and Script (NASA Solar System Guide)
Planet Characteristics (Can be obtained from the Internet)
Styrofoam shapes, pantyhose eggs, Aluminum foil, toothpicks, cotton balls, bubble wrap, wiggly eyes, buttons, beads, pipe cleaners, straws, paper, markers, glue, scissors

Procedure:
Define Habitability and Design Creatures

Scenario:

We are space travelers form a distant star system. The crew of our spaceship includes six different types of creatures who live on different planets in that star system. Our star is expanding and getting very hot. Our home planets are heating up and soon we will need new places to live. It is our mission to find habitable planets for our six different types of creatures with different life requirements. In all we need to find new homes for five billion inhabitants. First, we need to know what makes a planet habitable so we can set up probes to measure the characteristics of various planets. The different requirements for life can be related to measurable planetary characteristics. What do creatures require to live?

Title of Lesson: "Weigh" Out

Introduction:
The effects of gravity on weight and mass will be introduced. Students will understand how and why gravity shapes the universe. Gravity is a force that acts on all objects so that they are attracted to one another. Activities will be done to show how gravity pulls a thrown baseball to the ground. Demonstrations and labs will be done to show that the strengths of the attraction depend on the total amount of mass and the distance between the distances.

Essential Question:
- Does weight change from planet to planet and why?
- Why are astronauts on a space shuttle weightless?

Knowledge and Skills:
1) Calculate mass, weight, and gravity on other planets and the moon.
2) Develop and understanding of Earth and the solar system
3) Practice multiplication skills.

Evidence of Understanding:
Students will be given a Mathematical Computation Quiz to solve problems related to mass, weight and gravity.

Critical Thinking:
How could you prove Einstein's theories of gravity using the "gravitational lens"?

Title of Lesson: High Flyer I

Introduction: Students will study the works of by Sir Isaac Newton. Demonstration on the effects of gravity on or near the earth will be illustrated. How force holds the planets in orbital? Is the pull of gravity the same for everything on its surface? What affect will the pull of gravity have on different objects with different mass and matter will be emphasized with hands-on experiments and activities? Can two objects such as marbles of the same size start at the same point and same time one on a slope the other on a plane have the same results?

Essential Question:

- How does gravity affect objects on the Earth?

Knowledge and Skills:

1) Collect and organize data to show a complete process
2) Analyze data from the "High flyer" (" Airplane Design," p. 13)
3) Utilize tools of science
4) Make observations
5) Explain and describe gravity and centripetal force

Evidence of Understanding:
Students will explain the results of their experiments and use other research to support their findings.

Critical Thinking:
Students will do further research and investigations on designs of airplanes. Why should the designs of airplanes different? How does the design affect the speed and landing of an airplane?

Activity: Airplane Design

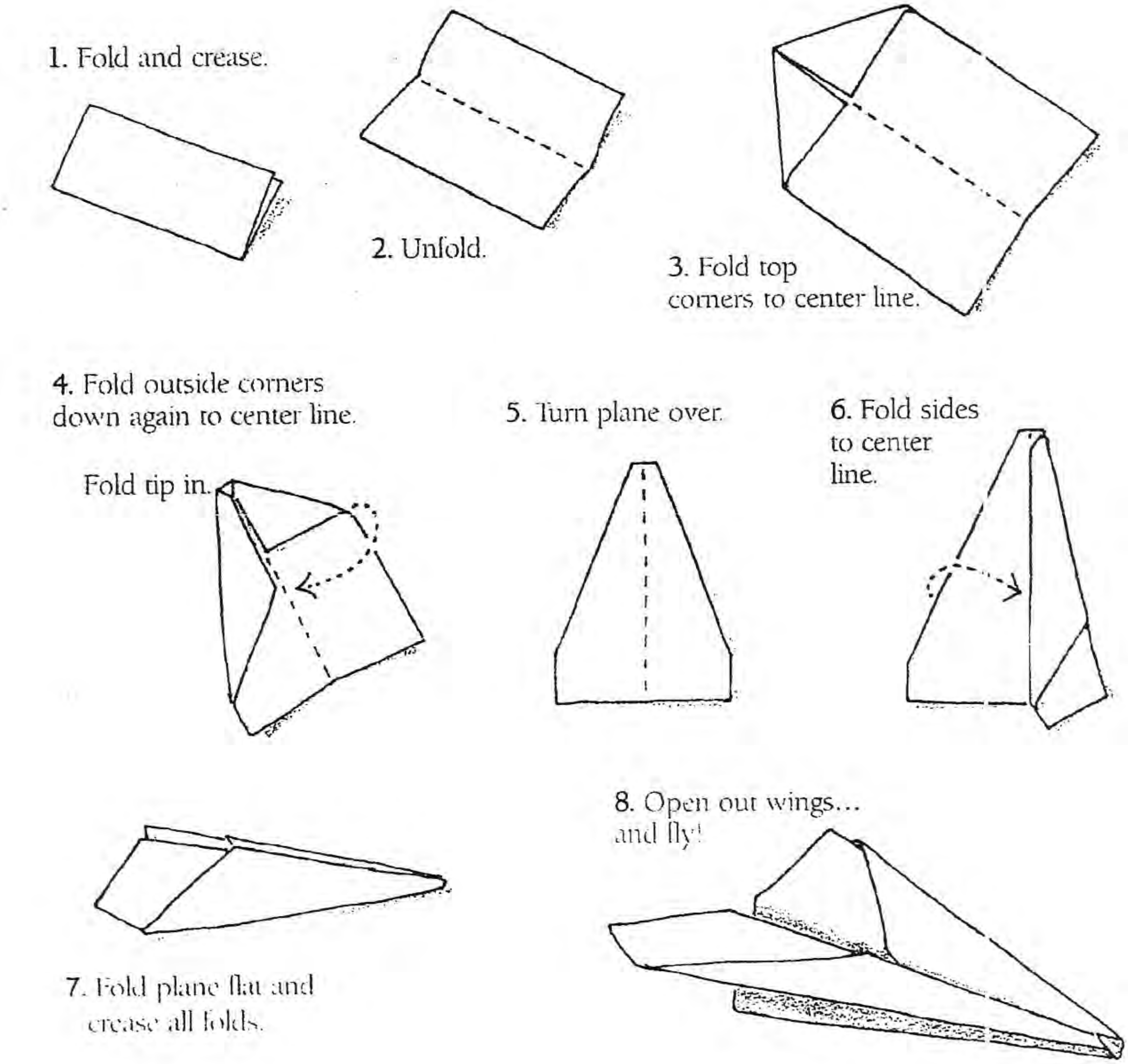
In a paper airplane design, the goal is to design a plane that will stay in the air for a long time before gravity pulls it down.

You will need:

- 1 Sheet of typing paper
- 1 Sheet of wax paper
- 1 Sheet of aluminum foil
- Adhesive tape
- Paper clips
- Tacky clay

Design for Basic Paper Airplane

1. Fold a sheet of typing paper in half lengthwise and crease it.
2. Open up and flatten the sheet.
3. At one end, fold both corners down, lining edges up with the center crease.
4. Fold each corner edge down again, against the centerfold, and crease well. Fold in the sharp point for safety when tossing.
5. Turn the paper over.
6. Fold the two outer edges back into the creased centerline.
7. Fold the plane together and crease all folds well.
8. Bend the wings out into position and test fly your plane.



Procedure:

1. Make three paper airplanes using the design given above. Make one plane out of typing paper, one out of wax paper, and one out of aluminum foil.
2. Fly your planes and observe which plane stays in the air the longest.
3. Experiment with different airplane designs using the three different types of material. Take note of which airplane stays in the air the longest.
4. Experiment with different ways of keeping the plane together:
   - Try putting a small amount of flattened tacky clay in the fold at the front of the plane.
   - Try placing a paper clip on the bottom of the plane, near its middle.
   - Try putting a piece of tape on the plane's nose, or across its wingspan.

   Take note of which changes make the plane stay in the air longer and which changes make the plane fall to the ground faster.

Answer the following questions:

- Do planes fly better when there is wind?
- Should you launch your plane into the wind or with the wind behind you?
- Do you get better flights if you just toss the plane easily or if you throw them harder?

Make a chart of your flight tests and compare the results.

Title of Lesson: High Flyer II: Designing Paper Airplanes for Distance

Introduction:

Students will experiment with different airplane designs using three different types of material. A design that works best for the aluminum plane might not work well for the plane made out of wax paper. Experiment with different ways of keeping the plane together: Try putting a small bit of flattened tacky clay in the fold at the front. Try placing a paper clip on the bottom of the plane, near its middle. Try putting a piece of light tape on the plane's nose, or across its wingspan. Do the planes fly better when there is a wind? Should you launch the planes into the wind or with the wind behind you? Do you get better flights if you just toss the planes easily or if you throw them harder, trying to make them go farther? Make a chart of your flight test and compare the results.

This experiment will help students to gather some baseline information, make one variable and test the results, make another variable and test the result, choose a paper plane design that will fly the farthest and test the results, graph the longest and average distance flown for each of the paper plane trails.

Essential Question:

- Why are airplanes designed differently?

Knowledge and Skills:

Use of the scientific method
Follow directions

Evidence of Understanding:

Students will design different types of airplanes and test how far the airplanes fly, fly the plane, calculate the speed of the plane, and horizontally graph the results of the longest flight and the average flight for each type of plane. Students will be assessed using the holistic and project generator rubrics (Appendices 4 and 5).

Using the same design students will make flaps at the back of the plane then the students will test the design and compare to other designed planes.

Critical Thinking:

Why is a "postal stamp" plane design of importance? Where does it land? Why?

Title of Lesson: The Drop Zone

Introduction:
Demonstrate of a condition where some of the effects of gravity are reduced compared to those experienced on Earth will be conducted. Students will also experience how to create microgravity by simply dropping objects. Students will observe gravity's influence on the objects to become nearly zero. The investigation will show how a released object, after being suspended in the air, will immediately relax and lessen its weight after gravity is reduced. The law of gravity will be explained. Explanations given by Newton using the law of the universe to redefine Kepler's third law will be given.

Essential Question:
- What is Microgravity?

Knowledge and Skills:
1) Explain and describe gravity
2) Explain and describe microgravity – Use Kepler's third law
3) Investigate microgravity and gravity
4) Utilize technology to explain orbital motion of the earth and other plants

Evidence of Understanding:
Use graphic organizers to show understanding of microgravity.

Critical Thinking:
Discuss the implications of microgravity on space suit design. For example, how can fluids (water cooling system, gas circulation, etc. be moved in microgravity?) Newton used the law of universal gravity to define Kepler's third law. Explain what this means.

Title of Lesson: Ski Jump

Introduction: This activity is an introduction to the concept of gravity. Students will gain first hand knowledge of the natural phenomena of gravity through guided experimentation using marbles. This activity will allow the students to make observations about the force of gravity and to compare its effects on objects moving horizontally at varying speeds.

Essential Question:

- Do size or horizontal speed affect the pull of gravity?
- Is the pull of gravity the same for all objects on the Earth's surface?
- Why does a skier plunge downward instead of flying off into space?

Knowledge and Skills:

1) Form a hypothesis
2) Make observations
3) Collect and organize data
4) Analyze data to make a conclusion about the experiment

Evidence of Understanding: Students will do the activity "Ski Jump," p.19). Activities will be assessed using holistic and activity generated rubrics (Appendices 4 and 5).

"Ski Jump" Activity

The pull of the Earth's gravity is the same for everything on its surface. But what if you were to drop a marble, and at the same time throw a second marble from the same height? Would both marbles hit the floor at the same time?

You know, of course, that the thrown marble would travel farther away from you, and that gravity would still pull it down, just the same as the marble that was dropped. But this project will prove that even though an object is moving fast parallel to the ground (sideways, not up and down), gravity will make it hit the ground at the same time as a marble simply dropped from the same height.

You will need:

- Modeling clay
- Cardboard
- 4 Rulers
- 2 Marbles of equal size
- 2 Marbles of different size
- Table
- Bare floor beneath the table

Procedure:

1. Place the cardboard on the table to keep it clean.
2. Put two mounds of modeling clay on the cardboard that is on the table.
3. Make one mound about 1 inch high.
4. Make the other mound 7 inches high.
5. Push two rulers into one end of the short mound, forming a "V" shape (measuring edge inward). This will make a ramp for a marble to roll down.
6. Using two more rulers, make another "V" ramp and set it on the higher mound of clay.
7. Mold the clay around the rulers to keep them in place. You should now have two marble ramps, one with a low slope and one with a high slope. (The marble on the ramp with the low slope will travel slower than the marble on the ramp with the high slope.)
8. Place the low ends of the ramps about one inch from the edge of the table.
9. Experiment with positioning the marbles on their respective ramps in such a way that they hit the tabletop at the same time. You will know that both marbles are hitting the table top at the same time because you will hear one sound as they hit the tabletop, instead of two sounds. (The marble on the low speed ramp should be placed further up on the ramp than the marble on the high-speed ramp.)
10. Once you get both marbles to leave the tabletop at the exact same time, listen for the sound of the marbles hitting the floor. (Both marbles should hit the floor at the same time. Both marbles will fall the same distance in the same amount of time, but the one that fell from the high-speed ramp will have traveled farther from the table than the one that fell from the low-speed ramp.)

11. Once you are satisfied with the results of your same-sized marble experiments, do the same test using two different-sized marbles and compare your results. Does the size of the marble count?

Critical Thinking:
The value of the Earth's gravitational pull is $9.8 m/s^2$. If there were an increase or decrease in gravity, what would happen to the objects on Earth? Explain your answer in two-three paragraphs.

Appendix 4

Holistic Scale

4

- The student completes all important components of the task and communicates ideas clearly
- The student demonstrates in-depth understanding of the relevant concepts and/or processes
- Where appropriate, the student chooses more efficient and/or sophisticated processes
- Where appropriate, the student offers interpretations or extensions (generalizations, applications, analogies)

3

- The student completes most important components of the task and communicates clearly
- The student demonstrates understanding of major concepts even though he/she misunderstands less important details

2

- The student completes some important components of the task and communicates clearly
- The student demonstrates that there are gaps in his/her conceptual understanding

1

- The student shows minimal understanding
- The student unable to generate strategy or answer may display only recall
- Answers lack clear communication
- Answer may be totally incorrect or irrelevant

0

- Blank/no response

Appendix 5

Name: ________________________ Date: ________________________

Project Title: ____________________________ Teacher(s): ____________________

Project Rubric Generator

Process	**Below Average**	**Satisfactory**	**Excellent**
1. Has clear vision of final product	1, 2, 3	4, 5, 6	7, 8, 9
2. Properly organized to complete project	1, 2, 3	4, 5, 6	7, 8, 9
3. Managed time wisely	1, 2, 3	4, 5, 6	7, 8, 9
4. Acquired needed knowledge base	1, 2, 3	4, 5, 6	7, 8, 9
5. Communicated efforts with teacher	1, 2, 3	4, 5, 6	7, 8, 9
Product (Project)	**Below Average**	**Satisfactory**	**Excellent**
1. Format	1, 2, 3	4, 5, 6	7, 8, 9
2. Mechanics of speaking/writing	1, 2, 3	4, 5, 6	7, 8, 9
3. Organization and structure	1, 2, 3	4, 5, 6	7, 8, 9
4. Creativity	1, 2, 3	4, 5, 6	7, 8, 9
5. Demonstrates knowledge	1, 2, 3	4, 5, 6	7, 8, 9
6. Other	1, 2, 3	4, 5, 6	7, 8, 9

Total Score: ____________________________

Teacher(s) Comments:

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HOWARD UNIVERSITY

College Of Engineering,
Architecture and Computer
Sciences

Increasing Underrepresented Minorities in Mathematics: An Informing, Encouraging and Reinforcing Three Tier (IER) Program

Funded by the
General Electric Foundation

imagination at work

Students in grades seven and eight will participate in on-campus summer courses in Algebra and Geometry. This program will establish academic opportunities designed to increase and sustain the number, quality, and diversity of high school students taking mathematics. The program is designed to increase and sustain the number, quality and diversity of high school students taking Algebra through Calculus in high school therefore making them better prepared to pursue careers in engineering, science or mathematics.

Project Personnel
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Dr. Lawanda Peace, Co-Project Director
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Ms. Camelia Sadler, Graduate Assistant
Ms. Audrey Johnson, Graduate Assistant
Mr. Rhese Gibson, Facilitator

Instructors:
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Mr. Thomas Lawson, Mathematics
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Dr. Janice Keyser, Pedagogical Specialist
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HOWARD UNIVERSITY

College of Engineering, Architecture and Computer Sciences Increasing Underrepresented Minorities in Mathematics: An Informing, Encouraging and Reinforcing Three Tier (IER) Program

A Summer 2006 Mathematics Institute for Teachers and Students

Teachers Toolkit

Funded by General Electric

GE imagination at work

PROJECT SUMMARY

Howard University is offering the second phase of a comprehensive professional development program for secondary mathematics teachers and students during the summer of 2006. Mathematics teachers of grades seven, eight, nine, and Algebra I from Ballou, Coolidge, and Dunbar High Schools and their feeder schools will participate in a multi-modal alternative learning environment conducive to promoting student success in Algebra and geometry. The incentive for this program (reauthorized under Title IV, Part B, of the No Child Left Behind Act) is to establish enrichment opportunities designed to increase and sustain the number, quality, and diversity of high school students taking mathematics. Course offerings, discovery mathematics programs, development of a mathematics toolkit and toolkit training will provide engaging mathematics instruction for teachers and students. The program is designed to increase and sustain the number, quality and diversity of high school students taking Algebra through Calculus in high school therefore making them better prepared to pursue careers in engineering, science or mathematics.

PROJECT PERSONNEL

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TEACHING FOR UNDERSTANDING: "ROADMAPPING" DCPS STANDARDS

In order to teach content standards, teachers and others involved in implementing standards in DCPS classrooms need strategies for identifying just what the standards mean and how to impart them effectively to students. Among other strategies, DCPS has adopted a process to create classroom "roadmaps" for its standards, adapted from the work of Grant Wiggins and Jay McTighe, authors of *Understanding by Design.*

While teachers throughout the district will be involved in this methodology, curriculum writing teams have developed the following exemplar roadmaps in reading/English language arts and mathematics for each grade. A blank template also is available for teacher use (and can be downloaded from the DCPS Web site).

Here is a brief explanation of the roadmapping process:

The first step is to "unwrap" the standards for the purpose of determining the critical concepts and skills contained within them. The second step is to identify the "Big Ideas," or enduring understandings, from the identified concepts and skills. The Big Ideas offer a broad perspective, purpose, and rationale. They explain what students are doing and why or how their work today relates to larger ideas. The Big Ideas are what we want students to discover and remember long after instruction ends.

With these Big Ideas clearly in mind, we formulate "Essential Questions" to share with students at the inception of an instructional unit. Essential Questions are provocative and important to discuss and debate; they engage inquiry, run to the heart of the subject, and raise important conceptual or philosophical issues. These questions are meant to probe and stimulate student reflection and rethinking. They also guide educators in the selection of lessons and activities that will advance student understanding of the unwrapped concepts and skills. The goal is for students to be able to reflect on the Essential Questions and to state the Big Ideas *in their own words* by the conclusion of an instructional unit. Each roadmap includes a learning context that embeds the learning of practical skills and concepts within "Engaging Scenarios" that draw learners in and make them think, reflect, and decide. Engaging Scenarios bring the outside world into the classroom and provide the context for applying the standard. The purpose of including Engaging Scenarios is to demonstrate that learning can be made much more interesting than just flipping pages, viewing static graphics, and responding to multiple choice questions at the end of an advisory. They should motivate the student to get involved and answer the question "Why are we doing this?"

"Performance Tasks" are meaningful activities that require a range of behaviors, employing both lower and higher order thinking skills, and enable students to demonstrate their knowledge of the standard. In identifying Performance Tasks, we look for authentic activities, exercises, or problems that require students to create a response to a problem and then explain or defend it rather than simply select an answer from a ready-made list.

"Performance Assessments" are guides that make it clear to students exactly what they are expected to know and do. They fit hand in glove with the performance tasks and should cause students to demonstrate the degree to which they have mastered the standard that drives each roadmap. Roadmapping standards is a powerful practice that is central to the work of teachers, the students, classroom activities, and the norms and cultures of classrooms across the district. For further information on each component of the roadmap, see "Making StandardsWork," by the Center for Performance Assessment.

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September/October **Unit 2:** **Properties of Real Numbers** 2.5 weeks	**AI.N.1.** Use the properties of operations on real numbers, including the associative, commutative, identity, and distributive properties, and use them to simplify calculations. **AI.N.2.** Simplify numerical expressions, including those involving integer exponents or the absolute value, e.g., 3(24 – 1) = 45, 4|3 – 5| + 6 = 14; apply such simplifications in the solution of problems. **AI.P.2.** Use properties of the real number system to judge the validity of equations and inequalities and to justify every step in a sequential argument. **AI.P.3.** Demonstrate an understanding of relations and functions. Identify the domain, range, dependent, and independent variables of functions. **AI.P.4.** Translate between different representations of functions and relations: graphs, equations, sets of ordered pairs (scatter plots), verbal, and tabular.	*AI.N.1 Roadmap………Page 123* **Lesson 1:** Working with Commutative and Associative Properties **Lesson 2:** The Identity Property **Lesson 3:** The Distributive Property **AI.P.2.** **Lesson:** Whose Turn Is It
October **Unit 3:** **Solving Linear Equations** 2.5 weeks	**AI.N.1.** Use the properties of operations on real numbers, including the associative, commutative, identity, and distributive properties, and use them to simplify calculations. **AI.N.4.** Use estimation to judge the reasonableness of results of computations and of solutions to problems involving real numbers, including approximate error in measurement and the approximate value of square roots without the use of calculators. **AI.P.1.** Recognize, describe, and extend patterns governed by a linear, quadratic, or exponential functional relationship or by a simple iterative process (e.g., the Fibonacci sequence). **AI.P.2.** Use properties of the real number system to judge the validity of equations and inequalities and to justify every step in a sequential argument. **AI.P.13.** Solve equations and inequalities, including those involving absolute value of linear expressions (e.g., $\|x - 2\| > 5$), and apply to the solution of problems.	*AI.P.13. Roadmap…..Page 142* **Lesson 1:** Inequalities in our World **Lesson 2:** Linear Inequalities – Writing and Graphing **Lesson 3:** Inequalities
October/November **Unit 4:** **Graphing Linear Equations and Functions** 3 weeks	**AI.N.2.** Simplify numerical expressions, including those involving integer exponents or the absolute value, e.g., 3(24 – 1) = 45, 4|3 – 5| + 6 = 14; apply such simplifications in the solution of problems. **AI.P.1.** Recognize, describe, and extend patterns governed by a linear, quadratic, or exponential functional relationship or by a simple iterative process (e.g., the Fibonacci sequence). **AI.P.3.** Demonstrate an understanding of relations and functions. Identify the domain, range, and dependent and independent variables of functions. **AI.P.4.** Translate between different representations of functions and relations: graphs, equations, sets of ordered pairs (scatter plots), verbal, and tabular. **AI.P.5.** Demonstrate an understanding of the relationship between various representations of a line. Determine a line's slope and x and y-intercepts from its graph or from a linear equation that represents the line. **AI.P.6.** Find a linear function describing a line from a graph or a geometric description of the line (e.g., by using the point-slope or slope y-intercept formulas. Explain the significance of a positive, negative, zero, or undefined slope. **AI.P.7.** Find linear functions that represent lines either perpendicular or parallel to a given line and through a point (e.g., by using the point-slope form of the equation). **AI.P.13.** Solve equations and inequalities, including those involving absolute value of linear expressions (e.g., $\|x - 2\| > 5$), and apply to the solution of problems. **AI.P.14.** Solve everyday problems (e.g., compound interest and direct and inverse variation problems) that can be modeled using linear or quadratic functions. Apply appropriate graphical or symbolic methods to the solution. **AI.D.1.** Select, create, and interpret an appropriate graphical representation (e.g., scatter plot, table, stem-and-leaf plots, circle graph, line graph, and line plot) for a set of data, and use appropriate statistics (e.g., mean, median, range, and mode) to communicate information about the data. Use these notions to compare different sets of data.	*AI.P.5. Roadmap………Page 158* **Lesson 1:** What is "Slope"? **Lesson 2:** Slope in the Real World **Lesson 3:** Slope to the Rescue! AI.P.6. **Lesson:** Line Factory

March **Unit 9:** **Quadratic Equations And Functions** 3 weeks	AI.P.12. Find solutions to quadratic equations (with real roots) by factoring, completing the square, or using the quadratic formula. Demonstrate an understanding of the equivalence of the methods.	*AI.P.12. Roadmap……Page 185* **Lesson 1:** Writing and Solving Two-Ste p Equations **Lesson 2:** Writing and solving Absolute-value Equations **Lesson 3:** Writing Solving, And Graphing Inequalities **Lesson 4**: Writing, Solving, and Graphing Absolute-Value Inequalities

Geometry
DCPS Scope and Sequence
1st Advisory

DCPS Time Frame	Standards	Page
September/ October/November **Unit 1:** **Points, Lines, Planes, and Angles** 9 weeks	**G.G.1.** Know correct geometric notation, including the notation for line segment (AB) and angle (<ABC). **G.G.4.** Draw and label sets of points such as line segments, rays, and circles. G.G.7. Use properties and theorems about congruent and similar figures and about perpendicular and parallel lines to solve problems. **G.G.9.** Distinguish between postulates and theorems. Use inductive and deductive reasoning, as well as proof by contradiction. Given a conditional statement, write its inverse, converse, and contrapositive. G.G.13. Apply properties of angles, parallel lines, arcs, radii, chords, tangents, and secants to solve problems. G.G.17. Demonstrate an understanding of the relationship between various representations of a line. Determine a line's slope and x- and y-intercepts from its graph or from a linear equation that represents the line. Find a linear equation describing a line from a graph or a geometric description of the line (e.g., by using the point-slope or slope y-intercept formulas). Explain the significance of a positive, negative, zero, or undefined slope. **G.G.18.** Using rectangular coordinates, calculate midpoints of segments, slopes of lines and segments, and distances between two points, and apply the results to the solutions of problems. G.G.19. Find linear equations that represent lines either perpendicular or parallel to a given line and through a point (e.g., by using the point-slope form of the equation).	*G.G.7. Roadmap ………Page 204* **Lesson 1:** Measuring Height with Similar Figures **Lesson 2:** Measuring Height with Mirrors **Lesson 3:** Measuring a Solar Eclipse with Mirrors *G.G.13. Roadmap ……Page 227* **Lesson 1:** All About Circles: Tangents **Lesson 2:** All About Circles: Tangents (Using Constructions) **Lesson 3:** All About Circles: Using Arcs **Lesson 4:** All About Circles: Using Chords of Circles **Lesson 5:** All About Circles: Observing Measures of Lines Intersecting Inside and Outside of a Circle **Lesson 6**: All About Circles: Observing Inscribed Angles *G.G.17. Roadmap ………..Page 274* **Lesson 1**: Reviewing the Human Coordinate Plane **Lesson 2:** Bungee Jumping with Barbie- Various Representations of a Line **Lesson 3:** Bungee Jumping with M&M's – Translating between Various Forms of Linear Equations *G.G.19. Roadmap ……Page 294* **Lesson 1:** Parallel and Perpendicular Lines - Foundations **Lesson 2:** Parallel and Perpendicular Lines – Foundations II **Lesson 3:** Parallel and Perpendicular Lines - Space **Lesson 4:** Parallel and Perpendicular Lines – City Scape

5E's Instructional Model

Stage of the Instructional Model	Teacher Does	Student Does
ENGAGE Initiates the learning task. The activity should make connections between past and present learning experiences, and anticipate activities and organize students' thinking toward the learning outcomes and current activities	• creates interest • generates curiosity • raises question and problems • elicits responses that uncover students' current knowledge about the concept/topic	• asks questions such as, Why did this happen? What do I already know about this? What can I find out about this? How can this problem be solved? • shows interest in the topic
EXPLORE Provide students with a common base of experiences within which current concepts, processes, and skills are identified and developed	• encourages students to work together without direct instruction from the teacher • observes and listens to students as they interact • asks probing questions to redirect students' investigations when necessary • provides time for students to puzzle through problems • acts as a consultant for students	• thinks creatively within the limits of the activity • tests predictions and hypotheses • forms new predictions and hypotheses • tries alternatives to solve a problem and discusses them with others • records observations and ideas • suspends judgment • tests ideas
EXPLAIN Focus student's attention on a particular aspect of their engagement and exploration experiences, and provide opportunities to demonstrate their conceptual understanding, process skills, or behaviors. This phase also provides opportunities for teachers to introduce a concept, process, or skill.	• encourages student to work together without direct instruction from the teacher. • asks for justification (evidence) and clarification from student formally provides definitions, explanations, and new vocabulary; uses students' previous • experiences as the basis for explaining concepts	• explains possible solutions or answers to other students • listens critically to other students' explanations • questions other students' explanations • listens to and tries to comprehend explanations offered by the teacher • refers to previous activities
ELABORATE Challenge and extend students' conceptual understanding and skills. Through new experiences, the students develop deeper and broader understanding, more information, and adequate skills	• expects students to use vocabulary, definitions, and explanations provided previously in new context • encourages students to apply the concepts and sills in new situations • remind students of alternative explanations • refers students to alternative explanations	• applies new labels, definitions, explanations, and skills in new, but similar situations • uses previous information to ask questions, propose solutions, make decisions, design experiments • draws reasonable conclusions from evidence • records observations and explanations
EVALUATE Encourage students to assess their understanding and abilities and provide opportunities for teachers to evaluate student progress	• refers students to existing data and evidence and asks, "What do you already know?" Why do you think…? • observes students as they apply new concepts and skills • assesses students' knowledge and/or skills • looks for evidence that students have changed their thinking • allows students to assess their learning and group process skills • asks open-ended questions such as, Why do you think…? What evidence do you have? What do you know about the problem? How would you answer the question?	• checks for understanding among peers • answers open-ended questions by using observations, evidence, and previously accepted explanations • demonstrates an understanding or knowledge of the concept or skill • evaluates his or her own progress and knowledge asks related questions that would encourage future investigations

DiSH

abetes

troke

ypertension

An Educational Awareness and Prevention Program for the Community

Science Education Partnership
The National Institutes of Health
National Center for Research Resources
Howard University, College of Medicine
Department of Microbiology and
School of Education

Hands on Inquiry Based Modules for Intermediate and Middle Schools

DiSH

Preface

Project DiSH is an educational, awareness, and prevention program for teachers, students, and the community. The constructivist lesson modules have been composed of instructional activities dealing with diabetes, stroke, and hypertension. The lessons included in this toolkit emphasize national science and health standards and utilize the components of the 5 E Instructional Model: *engagement, exploration, explanation, elaboration,* and *evaluation.* These lessons incorporate in-depth activities to broaden the awareness and exposure to the many aspects of diabetes, stroke, and hypertension which primarily afflict the African-American, Hispanic-American, and Native-American communities. The activities pinpoint risk factors such as genealogy, diet, and exercise to analyze the relationships between all three diseases. Games and group projects are used to evaluate the individual students' understanding of the illnesses.

The activities in this toolkit are inquiry-based and encourage students to be excited about their health and science. They can use the knowledge that they obtain in these activities to be more informed about decisions that they, their family, and friends make that may affect their susceptibility to diabetes, stroke, and hypertension.

Students and teachers will be excited about the activities enclosed in this toolkit and the exercises will generate stimulating conversation about diabetes, stroke, and hypertension.

DiSH

The Authors

W. Lena Austin, Ph.D. is a medical mycologist by trade; however she began her career as a middle school teacher in Wildwood, Florida. She has taught science content courses on the high school level as well as on the undergraduate and graduate levels. She uses the fungi as a tool to teach middle school students principles of cell biology, elementary principles of genetics and principles of microbiology in general. Being in the medical school environment has presented her the opportunity to continue the life long ambition of helping middle school students prepare for life's circumstances concerning their health and wellness. She continues to work closely with nationally funded programs from the National Institutes of Health.

Marilyn M. Irving, Ed.D. is an Associate Professor and Chairperson of the Department of Curriculum and Instruction at Howard University, Washington, DC. She teaches methods of teaching science at the elementary and secondary level. She currently coordinates, conducts training, and provides technical assistance for regional teachers in mathematics and science. She has designed lessons and resource materials for teachers throughout the nation. Dr. Irving is also the principal investigator for the "Developing Teacher Leaders in Middle and High School Science," project funded by the National Science Foundation. She serves as a consultant for numerous educational agencies to provide expertise in improving science education for all students.

DiSH

Acknowledgements

The creation of this toolkit has been an immense undertaking. Much thanks to all of the intermediate and middle school teachers whose detailed lessons are outlined throughout this toolkit. Without their dedication to the educational implementation of the DiSH project, this book would not be possible. Also, appreciation is given to Stephanie Erhueh for her compilation of instructional lessons, editing, and designing the visual layout of this toolkit.

Copyrights

DiSH

Toolkit Organization

This toolkit consists of instructional lessons that are geared toward intermediate and middle school teachers and students. All of the lessons are based on one or more of the themes relating to the goal of DiSH education (i.e. diabetes, stroke, and hypertension.)

The lessons are organized in order to facilitate the 5 E model of constructivist teaching. They include the following:

<u>ENGAGE</u>: develop activities that link prior knowledge with new knowledge. This stage should contain an activity that captures the students' interest and relates to a real-world scenario or problem.

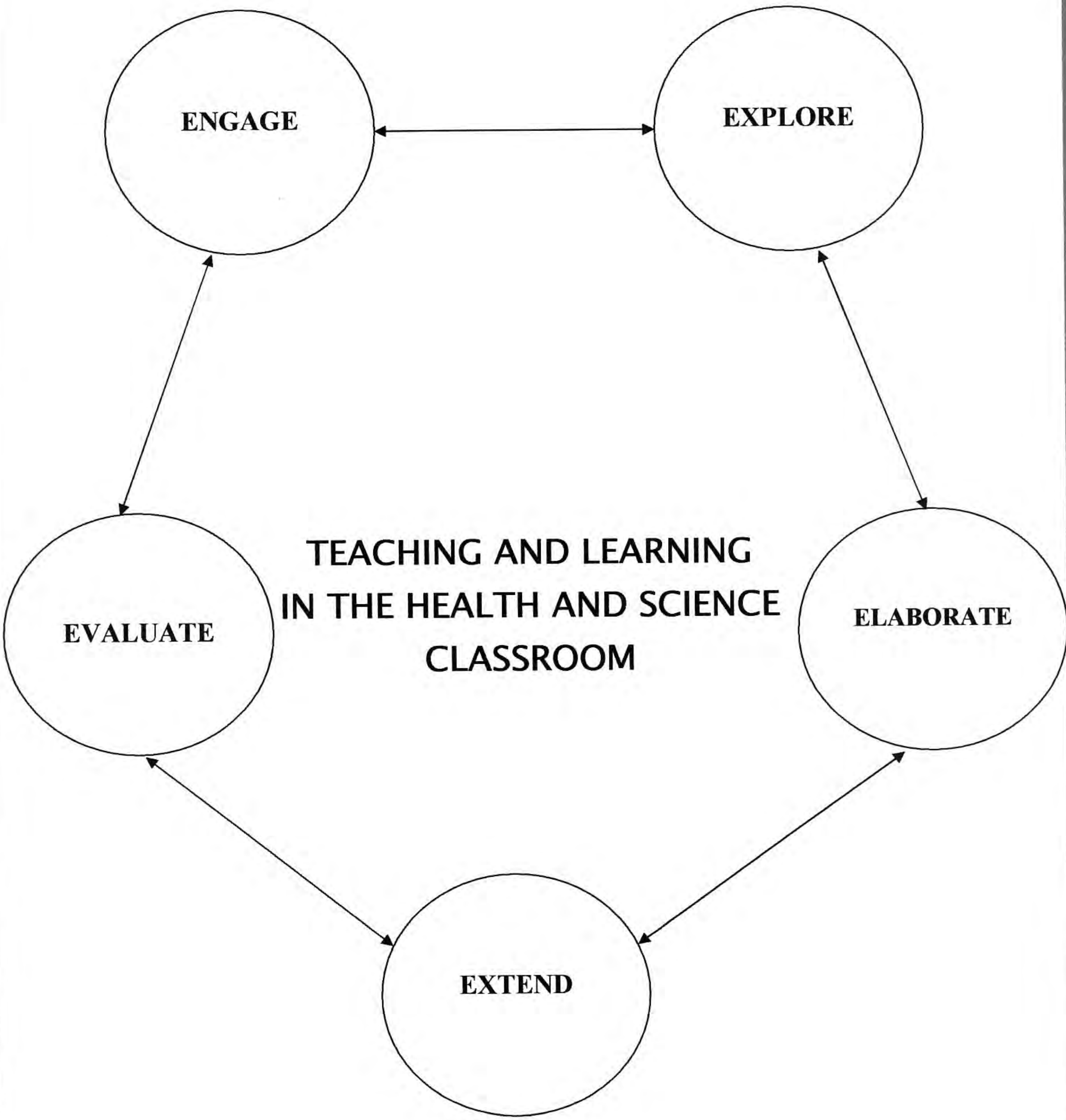
<u>EXPLORE</u>: provide inquiry-based experiences that enable students to explore a problem so as to develop new concepts, processes, and skills. During this stage, students make observations; organize and collect data; and draw conclusions.

<u>EXPLAIN</u>: encourage students to interpret and statistically interpret and analyze data from their explorations; to develop explanations and to refine or adjust previously formed concepts. During this stage the teacher can introduce new vocabulary and define and develop new concepts, skills, and processes. This stage also allows the teacher to identify and clarify student misconceptions.

ELABORATE: augment student learning; challenge students to link prior knowledge and to construct new knowledge. During this stage students should employ higher-order thinking skills to apply and synthesis new concepts, process, and skills.

EVALUATE: provide both the teacher and the student with the opportunity to assess student learning.

Inquiry-Based Learning: Using the Constructivist Teaching and Learning Cycle



The lessons incorporate various activities to investigate diabetes, stroke, and hypertension in order to gain a fuller understanding of each topic.

Experiments offer a hands-on learning experience allowing students to discover and analyze the concepts presented throughout the lesson.

Games furnish students with an interactive environment to collaborate with other students and demonstrate their knowledge of the information presented in the lesson.

Graphic Organizers provide students an opportunity to give a visual depiction of the various factors linked to the disease.

Journal Entries allow students to express their interpretation of various problems that the teacher may present to them with short readings and/or articles pertaining to diabetes, stroke, or hypertension.

KWLH Worksheets asks students the questions; What do I know?, What do I want to know?, What did I learn?, and How did I learn?

Lab Worksheets allow students to create a visual representation of the processes involved in the various experiments they perform.

Reports let teachers evaluate the individual student's understanding in an outlined research format.

Rubrics/Scoring Guides allow the teacher and student to evaluate the student's understanding of the topic presented by his/her display of their knowledge of the subject.

Surveys/Quizzes gauge various aspects of the different topics and its relevance to the individual student; give students and teachers an opportunity to see what he/she already knows.

Vocabulary gives students a working terminology to allow them to be able to communicate the various aspects of diabetes, stroke, and hypertension.

Websites/WebQuest give students and teachers additional resources to research the topics.

Wise Word Development evaluates the student's understanding of the vocabulary.

DiSH

Table of Contents

Selected Projects Developed

Dr. Marilyn Irving

Dr. Marilyn M. Irving
August 2005

Dr. Marilyn M. Irving, recipient of the Faculty Senate's "Inspirational Interdisciplinary Project Award," is an Associate Professor in the Department of Curriculum and Instruction in the School of Education. For years she has assisted science teachers in upgrading both their content knowledge and pedagogical skills. Well regarded for her achievements in both the classroom and the professional arena, she has earned words of praise from her students: "Her background education in science and science instruction gives her a uniqueness unmatched by other professors in the department," says one student. Meanwhile, another student recalls, "Her teaching style as a professor and her commitment toward the professional development of future teachers are just a few of her many assets that exhibit her commitment to the education system."

Such praise, however, does not come without a struggle. Says Dr. Irving, "the greatest challenge is to get young people interested in science." One often-used incentive to reel in new students is a scholarship. Therefore, Dr. Irving has devoted time and energy to securing funds for would-be science teachers so that they, in turn, can steer more students into science. For instance, with the aid of a $352,938 grant from The National Science Foundation, she and Dr. Leon Dickson, Jr. will ensure that 30 graduate students receive a $10,000 stipend toward pursuing a Master of Arts in Teaching. The project, entitled "Science and Mathematics for All," aims to increase the number of underrepresented minorities teaching mathematics and science in a Prince George's County public school district.

Another one of Dr. Irving's projects is "Increasing Underrepresented Minorities in Mathematics: An Informing, Encouraging and Reinforcing Three Tier (IER) Program" funded by General Electric. She also directs Advanced Placement programs designed to assist teachers who are teaching advanced placement biology, chemistry, and physics courses. The goal is to improve their teaching methods so that they can encourage more minority students to enroll in these courses and help those students perform well on advanced placement science tests.

With all of these commitments, Dr. Irving still devotes time to teaching. She teaches courses such as Integrated Methods II: Mathematics, Science, and Technology, Theories, and Principles of Curriculum Development, and Educational Psychology. An Educational Psychology student recalls, "The class served as a gateway to understanding the relationship between the teacher and the student." For Dr. Irving, often that relationship persists long after the class has ended. The most rewarding aspect of teaching, she remarks, "is to hear from students pursuing successful careers in science."

Selected Websites:

Featured Teacher:
http://www.howard.edu/school education/departments/candi/CI_Faculty.html

Interdisciplinary Award
http://www.cetla.howard.edu/featured_teacher/archive/irving.html

Top Researcher
https://www.howard.edu/schooleducation/research_spotlight/ResearchSpotlight.html

Exemplary Syllabus
http://www.cetla.howard.edu/new-showcase/awards/index.html#top

Ready to Teach Grant
http://www.ready to teachtoteach.org/overview/aboutus.html

Larry King Live: Bill Cosby Takes on Bullying
http://transcripts.cnn.com/TRANSCRIPTS/1004/18/lkl.01.html

Living Education Magazine Discusses Bullying: Video
http://education4and2parents.podbean.com/2011/04/15/living-education-magazine-discusses-bullying-video/

Straight to the Point – DC Comcast
http://octt.dc.gov/services/channel16/describe.shtm

Character Education
http://www.familynewsradio.com/

Fat Albert and the Cosby Kids Character Education Program
www.cosbykidscharactered.org

Fourth Annual

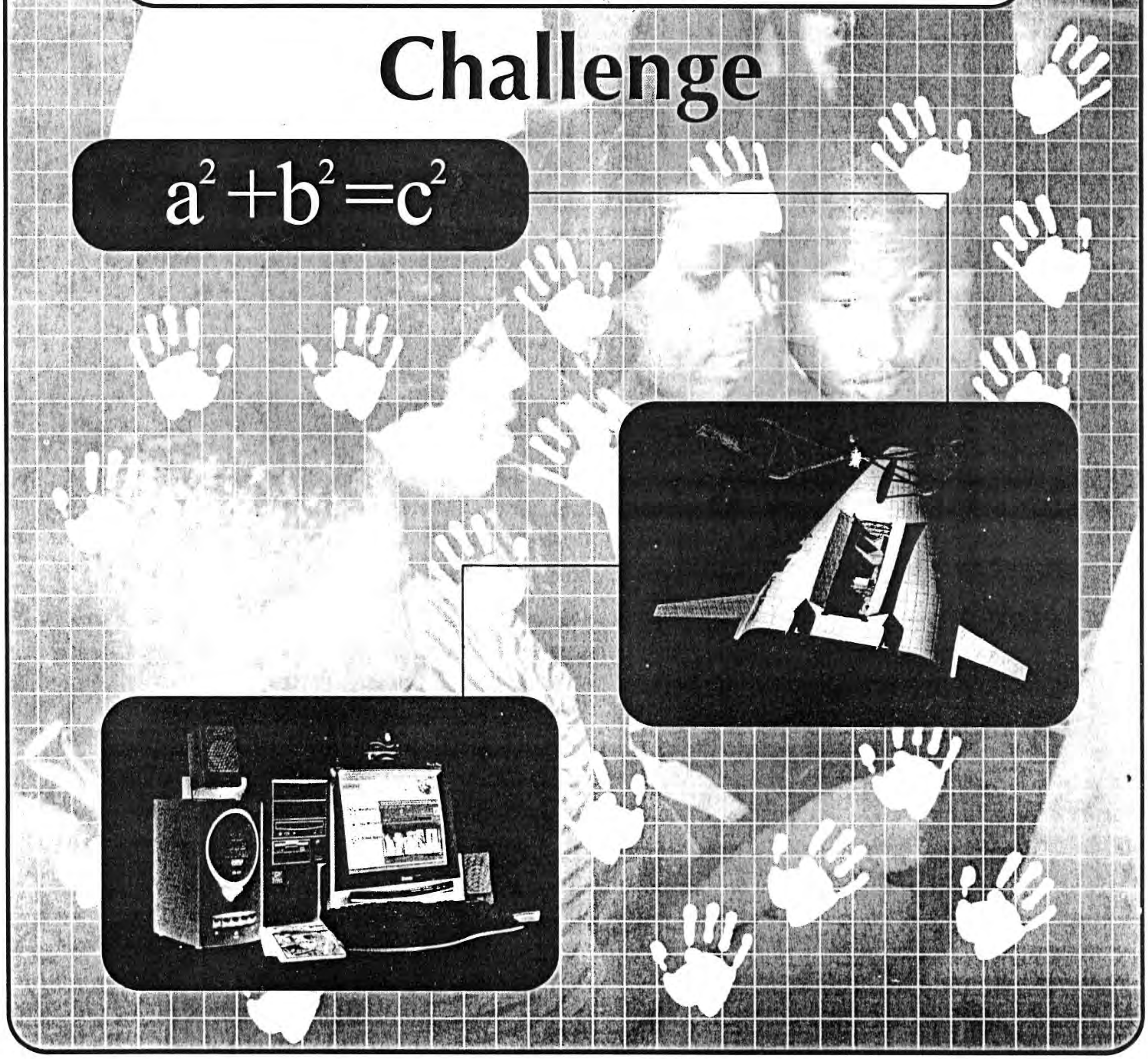
Pre-Service Teacher Education Conference

NASA Langley Research Center • Norfolk State University

Tomorrow's

Mathematics, Science, and Technology

Challenge



November 19-21, 1998

Hampton, Virginia

National Aeronautics and
Space Administration

Langley Research Center

Norfolk State University

Fifth Annual
Pre-Service Teacher Education Conference

Tomorrow's

Mathematics, Science, and Technology

Challenge

November 18-20, 1999
Hampton, Virginia

Special thanks to all student & faculty participants!

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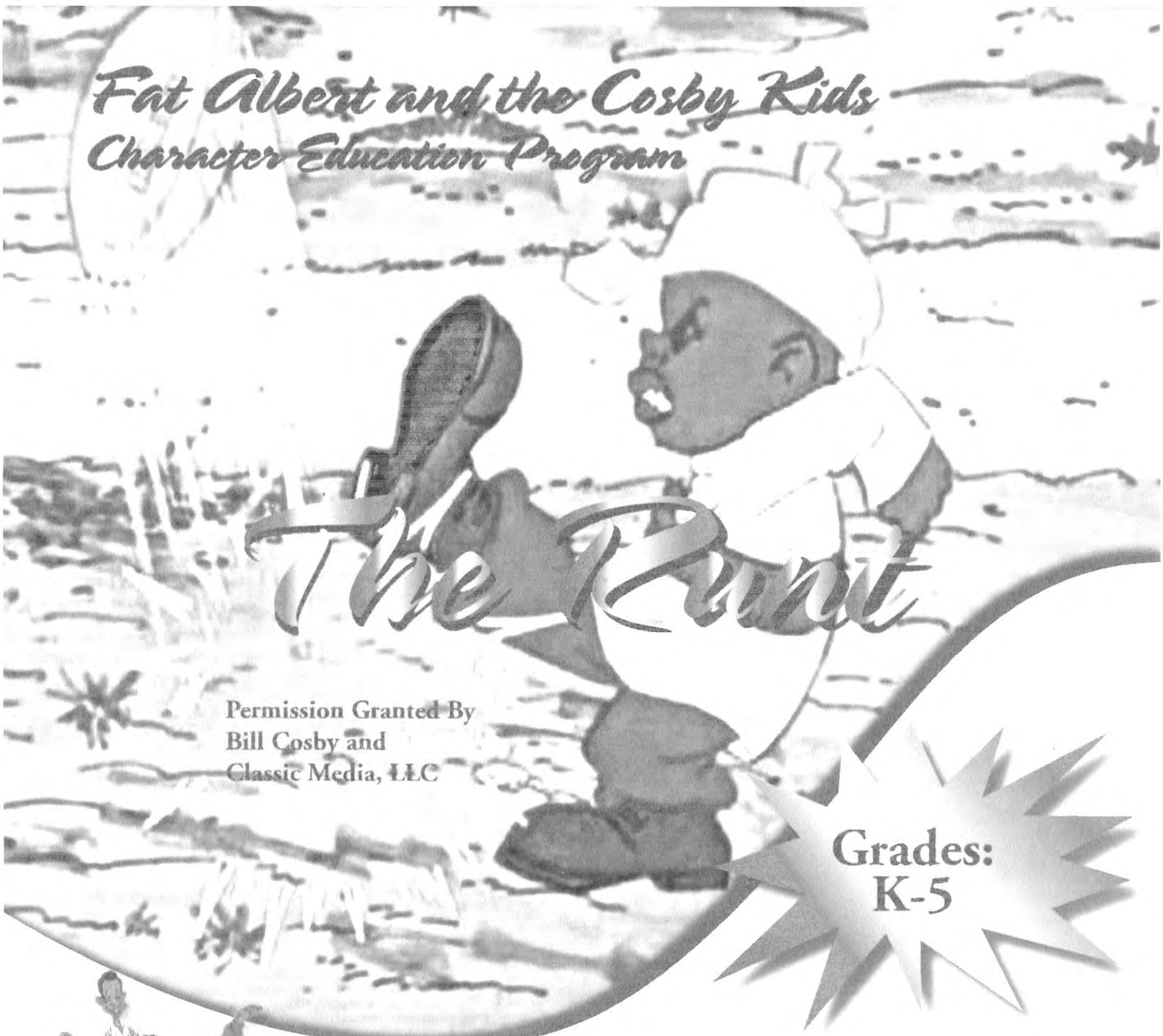
Fat Albert and the Cosby Kids
Character Education Program

The Runt



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Grades: K-5

Instructor's Handbook

Authors

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Myschelle Spears, Ph.D.

Foreword by Bill Cosby

Introduction

"Fat Albert and the Cosby Kids" Character Education Program
A Popular Animation Series Used as a Teaching Tool to Teach Morals and Values

The ***Fat Albert and the Cosby Kids*** DVDs can be used as a teaching tool to create and continuously encourage a culture of moral values in schools and communities. Teaching virtues such as respect and responsibility will assist youth in solving conflicts in a mature and responsible way. From 1972 to 1984, ***Fat Albert and the Cosby Kids*** themes had a great influence and impact on its audience. The theme in each episode reflects the concept: **Learn to live with who you are.**

Specific lessons have been developed around numerous themes from selected episodes of *Fat Albert and the Cosby Kids* DVDs. Students will observe firsthand the application of moral values in our nation's schools. Activities have been developed from the DVDs and songs from *Fat Albert and the Cosby Kids*—the original animated series. The major goals of the activities are to:

- help teachers and facilitators understand and access strengths buried beneath behavioral problems of children. The engaging activities will help
- combat the crisis youth face regarding violence and the breakdown of ethical and moral values
- assist youth in becoming more successful academically.

Through the use of these DVDs and songs, each student will learn critical information on the specific steps toward reducing anger and sadness, which will help to eliminate bullying and conflict. The use of the Fat Albert and the Cosby Kids DVDs will equip students with the knowledge, skills, and attitudes to effectively and peacefully handle conflict.

The major goals of creating activities linked to the content in the DVDs are:

- to help students to learn to live with who they are
- to be respectful of others
- to learn moral values that will assist them in making the right choices.

Additionally, the DVDs will foster in students the skills to manage interpersonal conflict and will give them practical methods for diffusing conflicts before they escalate into violence. Students are encouraged to participate in carefully structured activities that emphasize moral values. In addition to specific questions related to each video, students will have opportunities to respond to a variety of scenarios.

Cooperative Learning Strategies. It is suggested that cooperative learning strategies be used whenever possible. This section describes a variety of appropriate cooperative learning strategies.

Graphic Organizers. Examples of graphic organizers are located after the chapter notes. The instructor is permitted to make copies of these organizers to be used along with the instructional activities. Teachers are directed to use graphic organizers from Education Place: http://www.eduplace.com

Fat Albert and the Cosby Kids Leaders' Club. This section suggests criteria for establishing a "Fat Albert and the Cosby Kids Leadership Club." The purpose of the club is to encourage students to recognize and achieve moral values and to become responsible members of the local and global community.

The Instructor's Handbook:

An Overview

The goals and purpose of the ***"Fat Albert and the Cosby Kids"*** Character Education Program are to help students recognize and exhibit positive attitudes, self-confident and have realistic expectations of themselves. All of the modules in this series on character education initiate a dialog for expanding the ideals of ***Fat Albert and the Cosby Kids*** in order to reach youth. You, your school, and hopefully your community are now committed to the ideals of this project. We feel that every child needs to learn to live with who they are; and all children have the right to live, learn and succeed in a safe and moral environment. Your reflections and your ideas will help to extend pathways to success.

The student modules and the DVDs are protected by copyright laws. Please do not violate the copyright. Violation of copyright is punishable by law.

The Objectives. An enlarged copy of the objectives is found on the page following the overview section. This copy can be enlarged by the instructor; traced; or laminated. It is suggested that the objectives be posted.

Modules for the Runt contains the student modules for The Runt. When implementing these modules, we ask that teachers will construct a learning environment that promotes honesty, trust, and respectful behavior.

Teaching Approach. This section provides alternative teaching activities, teacher notes, references, and reflections. The activities in each modules gives students a chance to reflect on who they are and them to share information in a fun way with the rest of the class.

1. **The alternative teaching activities** supply examples of substitute or complementary activities that can be adjusted for various grade and ability levels.
2. **Teacher notes** contain the authors' suggestions for presenting activities
3. **References** include pertinent books and appropriate web sites that can be accessed for additional information and activities for various age and ability levels.
4. **Reflections.** We suggest that instructors do a self-evaluation to determine what works and what doesn't work for their specific student population. In this section the instructor can also include copies of student activities and student journals. The instructor's perceptions of students' attitudes are also important.

SECTION 3

The Objectives

1. Apply information from the video to solve problems.
2. Cooperate with others to discover solutions to problems.
3. Understand that there can be more than one solution to a problem.
4. Work with your team and your class to build new knowledge.
5. Work with your team and your class to use and to communicate new knowledge.
6. Reflect on what you have learned.

Family News Summit
Building One Family, One Community at a Time

Family News Summit.com

Press Release

For Immediate Release: May 26, 2010
Contact: Rob Gold PR Director: familynewssummit@yahoo.com
Phone: 803-319-3715

Family News Summit.com

Family NewsRadio.com and Irving and Associates Character Educational Services, Inc. will sponsor the 1st annual Family News Summit.com (Vienna, VA). **Dr. Bill Cosby**, educator and entertainer will host the character education component from "Fat Albert and the Cosby Kids' episodes. The Family News Summit.com will be held on **Saturday, July 17, 2010 from 8:00 a.m. to 3:30 p.m. at the Tysons Corner Marriott located at 8028 Leesburg Pike, Vienna Va**. Free Health Screening for Posture, Cholesterol, Glucose, Vision, Hearing and Body Mass Index will be available. This event is $5.00 in advanced and $7.00 at the door and opens to the public. Family News Summit.com will market an existing business, address questions and concerns families may have on financial matters.

Area businesses will be in attendance to give-a-way sample goods, discuss the services that they provide, and establish relationships with families. Throughout the day, keynote speakers and live performances of skits from the "Fat Albert and Cosby Kids; Character Education Program, will take center stage.

Sponsors include:

- Vienna Host Lions Club
- Café of Life of Herndon, VA
- Physicians Weight Loss Centers of Fairfax, VA
- Diabetes Research & Wellness Foundation
- Chick-Fila - Fairfax, A
- Mary Kay
- Community Mentoring and Counseling Services
- Forbes Financial Services
- Herbal Infusion
- Optimal Dental Center
- Project DiSH: Diabetes, Stroke and Hypertension
- Vienna Health Improvement Center
- Vemma-Liquid Vitamin
- Avon
- Shu-Mei Facial Beauty
- My Moms Personalized Books and Gift
- McFamily 3 Celebrations LLC
- NVideo Now
- T-Mobile
- USDA/FSIS- Food safety and Inspection Services
- Telecom Home Base Business
- The Tire Store
- John 3:16 Christian Bookstore
- I & A Jewelry, etc.

This Summit will be held annually and is especially designed to highlight family living, marriage, child development, health & fitness, investments, entrepreneurship, and much more.

Our focus is on issues and concerns that are important to the Family and community.

"Building One Family, One Community at a Time"

Table 4

Pilot Programs: "Fat Albert and the Cosby Kids"

Pilot Program Locations May 2008 to present	District of Columbia Public Schools (100 K-5 students) (June 2009) Clinton Independent School District, Clinton, AR (2008 to present) Selected Schools New Orleans ISD (2008 – present) Selected Schools (2) Nacogdoches ISD (2008 – present) Selected Schools (3) Prince George's County Public Schools Auburn State University, Auburn, AL – Classroom Management Course
May 2009	"Fat Albert and the Cosby Kids" Character Education Summit hosted by Dr. Bill Cosby. More than 300 persons were in attendance, consisting of teachers, parents and students represented from more than 8 states.
April 2010 **April 13, 2010** **April 2010**	Presented "Fat Albert and the Cosby Kids' modules to more than 200 childhood providers at the annual conference, Prince George's County, MD. Dr. Bill Cosby's guest on "Larry King Live" to discuss 'bullying" Hands-on presentation conducted with 300 elementary students
May 2010 – July 2010	Conducted a "Casting Call" for "Fat Albert and the Cosby Kids" to role play behaviors based on themes; more than 50 parents and children participated on a Saturday from 9 am to 1 pm. Ongoing.
July 2010	Character Education Summit for K-5 children and parents Host : Dr. Bill Cosby
July 2010	Workshop on Character Education/Building for High School and College Students

"Aim for the "Moon", even if you miss your will land among the "Stars"

Dr. Marilyn Irving

" is aiming for the moon and brightening stars and travels her journey"