Equity Dispatch

sTem: Technology and Equity

June 2013

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The newsletter at Great Lakes Equity Center is written and edited by Kitty Chen, James Kigamwa, Erin Macey, Jada Phelps, Marsha Simon, Seena Skelton, and Kathleen King Thorius.

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IMPACT: ***Educate, Engage, Empower--For Equity***

Teachers need to integrate technology seamlessly into the curriculum instead of viewing it as an add-on, an afterthought, or an event.

--Heidi-Hayes Jacobs

Educate

STEM education refers to the official enactment of a long-running national priority to increase expertise in science, technology, engineering, and mathematics disciplines (Lantz, 2009). While the bookends of the STEM acronym - science and mathematics – have received widespread attention, technology and engineering often get cursory consideration in equity-related conversations. With Internet- and technology-use becoming increasingly integrated into daily life, we must attend to opportunities to develop technological literacy (Frederick & Shockley, 2008). By literacy, we mean the ability to use technologies to communicate, solve problems, access, manage, and critically evaluate data, and acquire knowledge and skills (SETDA, 2003). Failure to integrate technological tools effectively and equitably within education structures risks exacerbating inequities that currently exist for marginalized students (Frederic & Shockley, 2008; Warshauer & Matuchniak, 2010). Several questions are worth deliberating to broaden equitable practices in technology education. What does 'technology' mean within STEM education? How helpful and accessible are technologies for students in K-12

Equity Spotlight

school systems? What are some current equity issues in this area? And what can we do to enhance equity in technology access and usage?

Examining the 'T' in STEM

The computer is often what comes to mind when we consider technologies in education, and technology literacy can be and often is narrowly conceived of as basic computing skills. However, technology literacy includes the ability to use a broad range of tools (e.g., cameras, phones, student response systems, video players, virtual research tools, digital portfolios) toward meaningful ends (AAUW Educational Foundation Commission on Technology, Gender, and Teacher Education, 2000; Morrison, 2006). For example, students might investigate their ancestry or engage in self-reflection using technological tools (Frederic & Shockley, 2008). Technologies can also engage learners in critiquing the everyday problems in their lives, including ways in which social structures oppress and marginalize certain groups (Blanton, Simmons, & Warner, 2001). These tools can and should also be integrated with other disciplines, improving student learning by facilitating deeper investigation of subject matter, local communities or the larger socio-ecological system (Lantz, 2009; Morrison, 2006). For instance, the Center for Children and Technology (CCT) integrates computer use into literacy instruction. It uses animation to attract students' attention while assisting them in associating letters with familiar animals or items (e.g., Z—zebra-zoo). Other uses may specifically encourage marginalized groups to engage with technology. The CompuGirls project, for instance, teaches primarily Latina and Black girls the latest technologies in digital media, game development, and virtual worlds, thereby building their confidence in this field. Unfortunately, technological resources are not equally accessible in schools, and the effectiveness of technology use in school systems needs further investigation and discussion to promote the creation of culturally responsive spaces.

How Accessible are Technological Tools in Schools?

When thinking about equity and technology, our concern often is whether or not schools have technological tools such as computers, video cameras, and smart boards accessible to all students. Here, the verdict is mixed. For example, while a recent study estimated that nearly 100% of schools have one or more instructional computers with Internet access, the ratio of students to instructional computers varies depending on the socioeconomic status (SES) of students at the school. Students in schools with low poverty concentrations have more opportunities and longer time to use computers when compared to students in schools with high poverty concentrations. The same report also shows that only 39 percent of public schools have wireless network access for the whole school, and less than 10 percent of schools have wireless connections only from laptops on carts (Gray, Thomas, & Lewis, 2010).

Differential home access to new media and technology can further amplify educational inequities in schooling. African American, Hispanic, and low-SES students are less likely to have computers at home (Judge, 2005), and this affects students' opportunities to engage these tools for learning in a less time-restrained manner (Warshauer & Matachniak, 2010). Also, teachers sometimes require technology to complete assignments or to initiate communication with families. Students who do not have these tools at home or who lack the skills to use them may be marginalized and pushed out of learning opportunities (Gorski, 2009). For instance, students who have Internet access at home can search for resources to complete their assignments. When they have difficulty solving a problem, or want to clarify their understanding, they can use instant messaging or texting to connect with peers and get their feedback. The dialogue initiated through technology can further students' thinking and provide them various learning opportunities. Not

Dr. Jomo W. Mutegi earned a dual bachelor's degree in chemistry and biology from Gannon University, gained a doctoral degree in science education from Florida State University, and completed a postdoctoral fellowship at the University of Pittsburgh.

An Associate Professor of Science Education at Indiana University, Indianapolis and Director of IU's Urban Center for the Advancement of STEM Education (UCASE), Dr. Mutegi conducts research on the science teaching and learning of students of African descent. As part of this work, he has written over 50 manuscripts that have been published in peer-reviewed journals, shared through popular venues, and presented at national and international conferences. He is also author of the book, *The Greatest Gifts a Parent Can Give*. He has received numerous invitations to present his research and ideas on education both in the United States and abroad. Dr. Mutegi is a 2003 recipient of the Outstanding Junior Scholar Award (presented by the Brothers of the Academy Institute) and a 2003 recipient of the US Early Career Researcher Award (granted jointly by the National Science Foundation and South Africa's National Research Foundation).

In addition to having served on the boards of several nonprofit organizations, Dr. Mutegi has maintained active membership in five international and national professional associations including the American Educational Research Association (AERA - the world's largest educational research association), and the National Association of Research in Science Teaching (NARST - the world's largest science education research association).

Dr. Mutegi has held professorships at the University of Pittsburgh and Morgan State University and has taught science and education courses at several community colleges, colleges, and universities. He is currently CEO of Sankoré Institute, an educational consulting firm committed

having these tools at hand can enlarge these opportunity gaps outside of school.

Even if the tools were equally distributed, there are also many school-level practices that limit access. For example, in some classes, iPads and computer time are used as part of reward systems (Warshauer & Matuchniak, 2010); students exhibiting appropriate "White standard" behavior get to use the iPad or computer to play video games during their break time. This denies access to some students and does little to increase literacy for those students who are allowed access (Gorski, 2008). Furthermore, in high-poverty schools, students are less likely to be asked to use technological tools to engage in higher order thinking activities, a trend that begins in early childhood classrooms; this is due in part to the fact that teachers in high poverty schools do not receive enough professional support to affectively apply technology into their teaching instruction (Gorski, 2008).

To What Ends are We Using Technology?

When there is access to technology, is it being leveraged to address equity concerns? Technological tools have the power to alleviate equity issues; they can open the doors to advanced courses in areas that do not have access and enable students with disabilities to fully participate in their school community. Thinking Reader, for example, makes texts digital, and in doing so, creates more flexible access for all learners. Sadly, not all students who need support from technological tools receive it; an Illinois survey shows less than half of the students with visual impairments receiving technology support to help them successfully participate in the curriculum (Kapperman, Sticken, & Heinze, 2002). In addition, the design of websites or programs is sometimes ineffective for students with disabilities (Lee & Templeton, 2008); for example, a lack of description of graphic images on a website or in an audiobook would limit the accessibility for students with visual impairments. A high priority for technology use, then, should be expanding access to learning for students with disabilities and other typically marginalized groups.

Moreover, to use technology effectively, students should not only be taught basic skills, but also how to use these tools to solve meaningful problems, promote dialogue, and engage in critical thinking. In fact, a recent study shows that randomly providing students with physical access has no effect on students' grades, test scores, attendance or disciplinary involvement (Fairlie & Robinson, 2013); *how* technological tools are used, then, is critically important. A recent meta-analysis of technology use studies suggests that using such tools to support students' efforts to achieve rather than to present content is key (Tamim et al., 2011). To this end, engaging students in the design of video games rather than playing of them would expose them to various challenges and facilitate the use of problem solving skills to enhance the game (Edutopia, 2013). Teachers could also extend students' engagement in class discussions through social media, encouraging them to share interesting news, speeches, or videos in their blogs or through Facebook. In these examples, technology becomes a vehicle for problem solving, ongoing dialogue, and critical thinking.

Technology can also assist teachers in the development of culturally responsive curricula. For example, teachers can ask students to take photos or make short videos of an aspect of their home or community to share with classmates or present at a community night. Technologies also allow access to a broad range of materials, reducing reliance on textbooks that may only reflect the dominant culture. In a recent case study, one instructor used content found on the Internet to acquaint her students with the intellectual contributions of African and African American people, while another encouraged students to locate texts from famous Black authors that were missing from the "official" school curriculum (Frederic & Shockley, 2008). How

to increasing the quantity and quality of African participation in science. You can learn more about Dr. Mutegi's work by visiting Sankoré Institute.

Upcoming Events

Illinois
July 20-24
K-12 Conference for Extraordinary Educators
Chicago, IL

July 30
Seeing the Forest from the Trees: Using Professional Learning Communities to Simplify and Unite your School Improvement Process and Incorporate Student Growth
CEC 25th Annual Summer Institute
Chicago, IL

Indiana
June 14
Emerging Scholars in Equity Community Conversations: Research to Practice
Indianapolis, IN

July 11
Indiana Black Expo Educator Conference
Indianapolis, IN

Michigan
July 8-11
Closing the Achievement Gap: Helping all Students Succeed

else can technological tools be engaged toward the creation of culturally responsive learning experiences? Conversations around this topic can be raised among parents, educators, and even students. Valuing their perspectives will result in greater benefits from the use of technological tools.

Plan of Action

To promote equity in technology education, here are some suggested actions.

- *Technology committee*: Develop a team of stakeholders to regularly review and assess access to, functionality of, and use of technology. This committee might ask: How are technologies being used in schools? Who has access to technologies? Is technology being leveraged to address equity concerns? To what extent is technology use culturally relevant and responsive?
- *Administrators:* Keep equity at the forefront when soliciting funds for technological tools. Ensure that staff and students have adequate technological support and learning opportunities (Anderson & Dexter, 2005).
- *Pre-service and in-service teachers:* Learn different technologies, invite technology into your pedagogical practice, and bring more meaningful, culturally relevant educational experiences and materials to students (Cooper & Bull, 1997).
- *Special Educators:* Understand the needs students with disabilities have, engage in ongoing learning about the technological supports that are available, and advocate to make technological tools accessible (Lee & Templeton, 2008).
- *Families:* Connect with schools closely, letting them know your family's abilities and concerns related to technology (Parette, Van Biervliet & Hourcade, 2000).
- *Students:* Speak up for your needs and make the best use of technologies to support your studies (Spires, Lee, Turner, & Johnson, 2008).

Have a question or comment about this article? Share it here!

Engage

UCASE, the Urban Center for the Advancement of STEM (science, technology, engineering, and mathematics) Education is a collaborative initiative at Indiana's leading urban higher education institution, Indiana University Purdue University, Indianapolis (IUPUI). This unique collaboration between three schools at IUPUI - the School of Science, School of Education, and School of Engineering and Technology - serves four goals: 1) Prepare exemplary STEM secondary teachers to serve diverse learners effectively in urban and high-need settings; 2) Recruit students from underrepresented groups who are interested in pursuing teaching in STEM areas; 3) Offer existing teachers professional learning within the STEM areas; 4) Engage in and disseminate scholarship advancing STEM education in urban areas (UCASE, 2013).

Lansing, MI

Minnesota
October 17-18
2013 Education Minnesota Professional Conference
St. Paul, MN

Ohio
July 31
Sharing Research- and Evidence-based Strategies to Increase the Participation of Under-represented Students in STEM Pathways: A Workshop for Participating STEM Equity Pipeline Project Team Members and Others Invested in Equity in STEM
Columbus, OH

August 5-7
Ohio Education Summer Academy
Columbus, OH

Wisconsin
June 16-21
Wisconsin Youth Leadership Forum
Madison, WI

June 19-21
Quality Educator Convention
Madison, WI

National
July 22-24
American Federation of Teachers TEACH Conference
Washington, D. C.

September 19-20
Equity Works
CTE Equity Council
Tulsa, OK

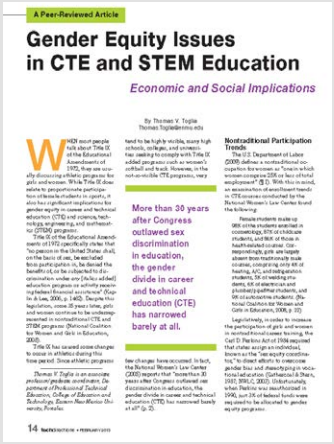
INDIANA UNIVERSITY
SCHOOL OF EDUCATION
IUPUI

Since 2006, UCASE has launched a number of programs for the preparation of recruited teachers through their partnership under the National Science Foundation (NSF) Robert Noyce Teacher Scholarship and Internship Programs. One highly regarded program is the Woodrow Wilson Indiana Teaching Fellowship, supported by the Woodrow Wilson Foundation and Lilly Endowment. Aligned with UCASE's mission, this dynamic program focuses on preparing a new generation of highly qualified STEM teachers dedicated to closing the opportunity gaps in STEM education. Fellows are offered the option of dual certification in STEM and special education so that they will be able to facilitate STEM learning with students with exceptional needs. Additionally, other UCASE-affiliated programs, such as the NSF-funded GK-12 Program, focus on civic engagement within the Indianapolis metropolitan area. Graduate fellows of the program work alongside local teachers to increase involvement in scientific questioning, data collection, and research-based high school projects.

UCASE has produced a number of stellar scholars who exemplify the organization's mission, such as Tayana Dowdell, a recent IUPUI graduate, who was recently recognized for her work, The Impact of Hip-Hop Instruction on Students in Urban Settings. Dowdell will begin teaching science education at an urban elementary school in Indianapolis beginning this fall. We commend UCASE for attending to representation and access in STEM teaching and learning.

Empower

Something to Read!


A Peer-Reviewed Article

Gender Equity Issues in CTE and STEM Education

Economic and Social Implications

More than 30 years after Congress outlawed sex discrimination in education, the gender divide in career and technical education (CTE) has narrowed barely at all.

This short peer-reviewed article discusses gender equity issues in career and technical education (CTE) and STEM education. It highlights some of the gains made as a result of Title IX of the Higher Education Amendments Act of 1972. The article also provides an overview of the Carl D. Perkins Act of 1984, which required states to recruit "sex equity coordinator(s)" in a quest to increase the participation of girls and women in nontraditional career training. Factors influencing women and girls' career choices and consequences of gender equity concerns are also discussed, highlighting research findings that indicate that women and girls from low income families have unrealized career expectations and face obstacles that reduce their career aspirations. The article also discusses some strategies for improving gender equity in CTE and STEM. These include treating students equally and recognizing the achievements of nontraditional students.

Something to Watch!

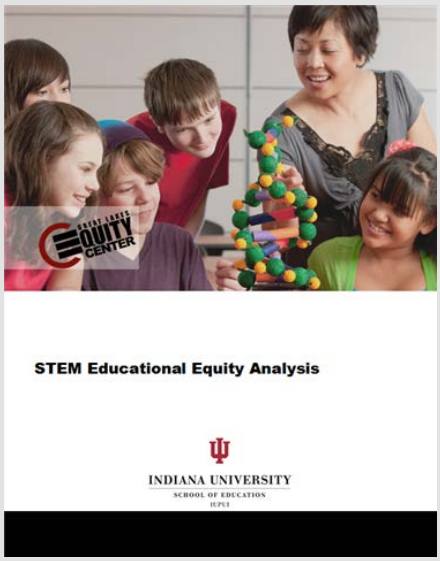
In this video, Freeman Hrabowski, President of

the University of Maryland, Baltimore County, presents "Beating the odds: Creating a climate of success for all students in STEM" at the 2013 Public Affairs Conference at Missouri State University. This is a truly inspiring presentation that highlights how to beat the odds and allow for all children to be involved in STEM education. Over the past three decades, Freeman Hrabowski has studied minority student achievement, focusing special attention on the participation and performance of African Americans in STEM fields. Dr. Hrabowski recently chaired the National Academies' committee that produced the report, Expanding Underrepresented Minority Participation: America's Science and Technology Talent at the Crossroads. In this video, he draws on this knowledge base to discuss best practices for creating both a culture of inclusive excellence and a climate of success for all students in STEM.

Something to Use!

Ready to evaluate your own STEM program?

This tool, developed by the Great Lakes Equity Center, is the perfect stimulus for conversation in your school community. It focuses attention on two major areas - organizational capacity and curriculum & instruction - facilitating evaluation and strategic planning. Gather a team of school leaders, teachers, family members, students, and community partners to launch your initial self-assessment and plan for change today!



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Engage:

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