Ramping Up *for* STEM Success

Pathways for Student Transfer
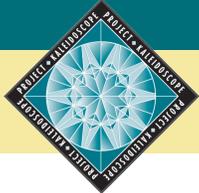
PROJECT OVERVIEW AND LESSONS FROM THE FIELD

New Models for STEM Transfer

By Susan Albertine and Susan Elrod

This report summarizes the results of an experiment to design programs aiming to increase transfer student success in science, technology, engineering, and mathematics (STEM)—in communities and regions in six states. We begin with the premise that successful transfer of students from two-year institutions to four-year institutions is critical to the future of our workforce and our civic democratic life. Almost half of all undergraduates attend community and technical colleges. That population is diverse, the US population of the future. Yet few students who start in two-year colleges earn baccalaureate degrees (Dowd 2011).

As a society, we are losing a vital pool of talent and potential. But it's not just about the numbers of degrees. Quality of learning and conditions for learning are critical: once students make it to the point of transfer, issues such as adequate preparation in mathematics, lockstep STEM degree requirements, and the culture of science departments present additional roadblocks.

Fortunately, we are finding evidence of qualitative change under way. In these pages we report on innovations in STEM transfer programs in six two-year/four-year partnerships involved in the Ramping Up for STEM Success project facilitated by Project Kaleidoscope (PKAL) and the Association of American Colleges and Universities (AAC&U).

With support from the Bill & Melinda Gates Foundation in 2011–2012, AAC&U and PKAL held two national convenings of six state partnerships. We organized these convenings as "Action Labs." State teams engaged in action research and a structured inquiry project to learn more about student success. They described current programmatic designs to address transfer student learning. They met and swapped both good practices and discoveries. The goal: to identify key features of replicable and scalable models, emphasizing general education and entry into STEM baccalaureate programs. Putting students at the center of the work, partners described holistic program improvements that aimed well beyond coursework articulation. They explored agreements to build partnerships, to design comprehensive alignment and student support programs, to assess evidence of their success. Here we have lifted up encouraging models and themes—a promising composite. We are pleased to share the results with you.

For more on the project, see the project's website: http://www.aacu.org/pkal/rampingupstem/index.cfm.

University of Maryland, Baltimore County

"Currently the United States graduates about 300,000 bachelor and associate degrees in STEM fields annually. Fewer than 40% of students who enter college intending to major in a STEM field complete a STEM degree. Increasing the retention of STEM majors from 40% to 50% would, alone, generate three-quarters of the targeted 1 million additional STEM degrees over the next decade."

— President's Council of Advisors on Science and Technology

AAC&U Association of American Colleges and Universities

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President's Council of Advisors on Science and Technology. 2012. *Report to the President Engage to Excel: Producing One Million Additional College Graduates with Degrees in Science, Technology, Engineering, and Mathematics.* Washington, DC: Executive Office of the President.

Student-Centered Collaboration

By Susan Albertine and Susan Elrod

From Ramping Up, we have learned that institutions are not lacking in initiatives to improve transfer student success. As part of the project, we asked each partnership to complete an inventory of their transfer interventions. A pie chart based on that inventory (see sidebar) looks to us like a starburst. Collectively institutions are trying everything they know to increase persistence and completion. But do they know what works in context? Many of the interventions are promising and have documented success. Articulation agreements, guaranteed transfer, and aligned advising do make a difference. So do bridge programs, peer mentoring, tutoring, aligned pedagogy. Student success research does provide evidence of the impact of academic support programs. Yet we know all campuses can't do it all. Intentionality matters. In tight budget times, a "starburst" approach is not sustainable. Instead, taking an evidence-based approach, using metrics and gathering qualitative and quantitative data on student learning and student flow into and out of programs, campuses can figure out what works best in their context. With their own evidence, they can work deliberately with what succeeds in their community.

Which of the following elements does your STEM transfer program contain?

- Curriculum alignment between two-year and four-year institutions
- Policies for guaranteed transfer for students from community college…
- Cross-institution coordination mechanisms (committees, communication…
- Early advising of community college students
- Tutoring/peer mentoring
- Information and/or marketing campaign geared to target student population…
- Alignment of non-curricular program elements (e.g., advising, mentoring)
- Honors program for transfer students
- Alignment of pedagogy used in science and/or math courses
- Incentives for degree completion at the community college
- Summer bridge program
- Transfer orientation program for social and academic integration
- Online social outreach to students
- Transition courses in science and/or math
- Transition course in other disciplines (e.g., English)

The greatest challenge lies in creating holistic and integrated *program* alignments—aligned programs, pedagogy, academic support services. Such intentional design is more comprehensive and more promising—and harder to achieve—than the traditional course-by-course articulation. Program-level and general education learning outcomes need clear definition and alignment. So does advising. Transfer students need an equitable guidance to opportunity—not just an option—to participate in high-impact practices such as undergraduate research and science-based service learning, connected developmentally to their two-year programs.

Intentional partnership development across two-year and four-year institutions makes for integration and connected learning. Effective communication is vital for initiating and sustaining relationships that produce such results. A good first step is to share learning goals, as well as advising and transfer policies, and to understand the cultures of partner institutions (League for Innovation in the Community College 2010). Putting students at the center of discussion and building relationships that share the goals of student success can get partnerships off to sustainable work. Open and transparent communication builds confidence among faculty and staff so they can help students be more successful as they traverse complex terrain.

What we discovered through Ramping Up is not so much "new" as multifaceted. We found no single solution—no activity or intervention—that could serve in all cases. Success depends, instead, on larger-scale, inter-institutional collaboration on multiple levels—school, college, and university—for achievement and success, using holistic, intentional, learning-centered, equitable approaches and a positive outlook on the promise and talents of transfer students in the communities where they live and work.
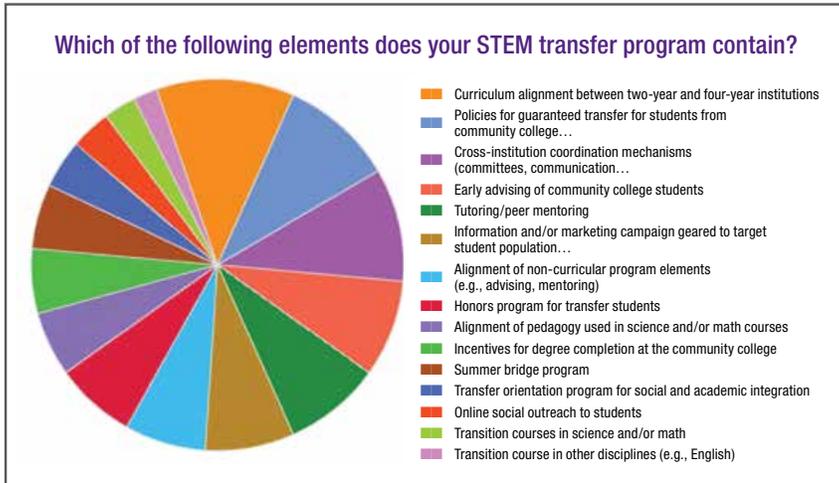
"In spite of the strident pursuit of standards-based reform of two-year college mathematics, implementation of reform has been slow and uneven. National studies show more students are enrolling in two-year college mathematics, but a substantial portion of them are at the pre-college level, and many of these students never reach college-level mathematics courses. A host of issues need to be addressed to improve two-year college mathematics and prepare more students for STEM-related careers."

— Debra Bragg (2002)

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Bragg, Debra. 2002. "Two-Year College Mathematics and Student Progression in STEM Programs of Study." Paper Commissioned for the Summit on Community Colleges in the Evolving STEM Education Landscape. http://nas-sites.org/communitycollegessummit/files/2011/12/Math-NASPaper-Bragg-12-9-111.pdf.

League for Innovation in the Community College. 2010. *Significant Discussions: A Guide for Secondary and Postsecondary Curriculum Alignment.* Phoenix, AZ: League for Innovation in the Community College, www.league.org/significantdiscussions.

Cochise College

Arizona Develops Curricular Pathways

Maricopa Community College District, Cochise College, and Arizona State University

By Maria L. Hesse

Arizona State University (ASU) has signed agreements with public community colleges in the state to "create a culture of transfer." ASU is a large research university with four campuses in metropolitan Phoenix. Partners include the Maricopa Community College District—composed of ten separately accredited colleges in metropolitan Phoenix—and Cochise College, which has several campuses in southeastern Arizona. Maricopa, Cochise, and ASU are jointly building curricular pathways that are web-accessible and understandable, while promoting strong academic preparation for student success. We are rethinking our support services to ease the transfer process. We are committed to reducing student time to graduation and thus costs, while partnering to help more students achieve associate's and bachelor's degrees.

We have jointly focused on the development of curricular pathways as a foundational element in transfer student success. Students who sign up for and complete all elements of a prescribed pathway are provided with incentives to stay on track. All coursework used in a pathway applies to both the associate's degree and the bachelor's degree, and students receive guaranteed admission to the specific university major to which they aspire, along with reduced tuition and access to ASU transfer advisors.

The Maricopa Community Colleges have the Maricopa to ASU Pathways Program (MAPP), with pathways developed in more than twenty-five STEM majors, including biological sciences, chemistry, geology, mathematics, environmental studies, and computer systems. The MAPP model is driving more proactive advising, earlier declaration of majors, and more intentional course-taking patterns.

Cochise College has the Transfer Admission Guarantee program, with pathways developed in biological sciences, chemistry, and mathematics. As part of a National Science Foundation project titled Motivated Engineering Transfer Students, Cochise is also working on a pathway for engineering students, which would be based upon an associate of applied science degree.

We have had success in developing curricular pathways for STEM disciplines, but we understand that articulated curricular pathways are the foundation on which other targeted programs and support services can be built. They are important but not sufficient components in a plan to improve student success. Thus we are working on additional tools to track student progress along their pathway to the university and to provide key communications at critical points along the way, as well as on more comprehensive support services for transfer students.
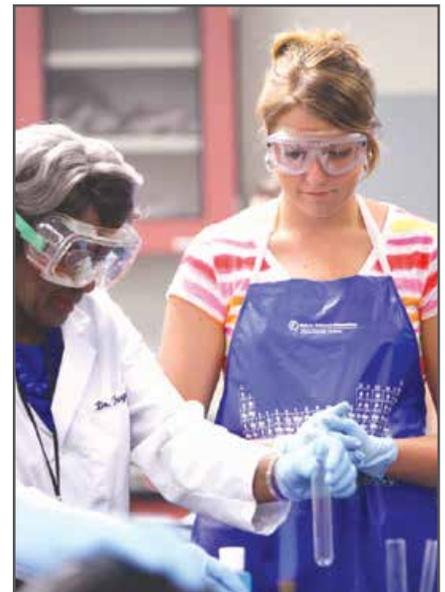
Maricopa Community College

California Drills into Data

Chabot College, College of San Mateo, and California State University, East Bay

By Tram Vo-Kumamoto

College of San Mateo

Over the past year, through participation in the AAC&U/PKAL Ramping Up for STEM Success project, Chabot College, College of San Mateo, and California State University, East Bay have partnered to take on the challenge of increasing the number of STEM transfer students in our region.

To really understand the challenge, we are starting to gather cohort data regarding our STEM students starting with fall 2008. The data analysis will help us better understand our students and their achievement. It will also help us to identify gaps that need to be addressed to increase success. At Chabot, a preliminary look at the data shows that we have a very diverse group of students coming into the college identifying a STEM field as their major. However, after three years only a small number have made it to calculus, one of the main gateway courses to the STEM pathway. Drilling deeper into the fall 2008 group of students, we saw that only 32 out of the 194 students completed Calculus 1 by spring 2011. With an even deeper look at the numbers, we see that underrepresented students are most at risk of not completing. As a matter of fact, only 1 in 30 African American and only 1 in 42 Latino students who entered in fall 2008 completed Calculus 1 by spring 2011. This discovery calls for further analysis of trends and action to address the learning and success of this and additional cohorts over time.

Once data analysis has been completed, the information gathered will be used to provide direction and focus for our project. With project goals identified, we will move into the program development phase and start with asset mapping and analysis of high-impact practices to address issues preventing our students from achieving. A preliminary look at best practices shows that learning communities built around a common educational experience through cohort courses, academic success workshops, internships, wraparound case-management support, tutoring, and peer mentoring are essential elements to increasing achievement. In addition, materials and features of the classroom experience such as syllabus development and classroom culture need to be evaluated by faculty to increase student engagement.

As a result of this work, Chabot College and College of San Mateo, with support from CSU, East Bay, will develop a stronger STEM transfer program that will address the specific needs of our students and focus on moving the needle on student achievement.

Florida Forges K–20 College Access and Success

Brevard Community College, Lake Sumter Community College, Seminole State College, Valencia College, and University of Central Florida

By Pamela Cavanaugh

University of Central Florida

Our Central Florida Regional Higher Education Consortium has developed a strategic agreement to address college access and success. The result: Direct Connect to UCF (DC2UCF), a nationally distinctive college-access plan.

DC2UCF Partnership meetings with partner colleges take place three times annually, with an annual summit conference for all constituents. Under the plan, working groups are charged to address access, choice, transition, progression, and academic and student services for guaranteed pathways from the partner colleges to University of Central Florida (UCF). Groups address data, resources, and curriculum

alignment as well as STEM recruitment and retention in K–12, college preparation, and assessment. We study student success, including the ways that STEM majors and graduates serve our community.

This year, the Florida College partners and UCF proposed a data model to the Florida Department of Education, Florida College System, and Florida Board of Governors so that data could be accessed and utilized by K–20 partners. This data collection model would provide for education and dissemination to stakeholders to strategically program and determine needs for continuous improvement for access, success, and completion.

Curriculum alignment initiatives with our partners provide a forum for faculty, administrators, curriculum designers, and area specialists to communicate regarding the currency and appropriateness of STEM curricula and programs. They focus on adjusting curricula at both course and program levels to ensure that content, depth of coverage, objectives, and outcomes for a given course are consistent from one institution to another, and that each course and program properly prepares students for success in subsequent courses and programs.

Grant writing professionals from our partner institutions identify shared goals and priorities of stakeholders through horizontal and vertical integration. All partners determine priorities in four areas: building pathways, providing quality learning experiences, contributing to the regional economy and workforce, and providing infrastructure to support access and learning outcomes.

Making a difference to advance STEM student success through central Florida's K–20 partnership depends on committed leadership of local school districts, Florida Colleges, and UCF. While it starts at the top, that leadership has empowered faculty, administrators, and staff to do the work it takes to keep adapting to the changing needs of our students, institutions, and communities.
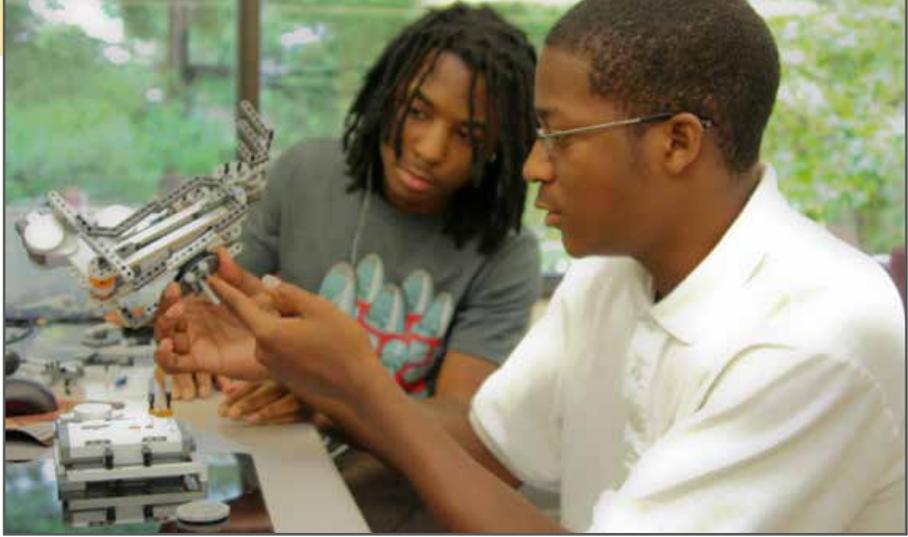
Howard Community College

Maryland Builds Strong Relationships

Anne Arundel Community College, Community College of Baltimore County, Howard Community College, Montgomery College, and University of Maryland, Baltimore County

By Sarah Jewett

We believe that strong relationships between two- and four-year institutions should be at the core of any STEM transfer initiative. Continuous development of these relationships offers powerful possibilities for initiating and sustaining commitments to student success. Based on our team's experience, there are at least three critical guidelines for this work:

♦ **Establish broad support for interinstitutional partnerships**
Example: Our transfer success initiative is supported by each of our five participating presidents, and the management team for it includes leaders from each of the institutions. Through processes of nomination by leadership and referral by colleagues, we also created an extended network of faculty, administrators, and staff to work on key issues within and across institutions. We gather regularly and rotate meeting locations.

♦ **Develop shared understandings based on beliefs, practices, and goals**
Example: Technology is essential for students to access institutional information and web-based systems. But equally strong is the role of personal interactions in supporting student success. Through our discussions, we developed a shared understanding of technology as a tool to enhance personal interactions between students, advisors, teachers, and mentors, and even to make them more efficient, but certainly not to replace them.

♦ **Create a safe space for learning with equitable terms for participation, room for multiple perspectives, and opportunities for growth and change**
Example: Originally, members of our team from the community colleges were skeptical about the nature of this institutional partnership. The implicit assumption was that this project presented another opportunity for universities to impose their perspectives and expectations on community colleges. Through the development of open and honest relationships, these members became active participants in the process and demonstrated a ready interest in our future work together.

All of us genuinely enjoy and respect our colleagues and value the range of experiences brought to the table. We have not only developed a set of useful tools and protocols, but we have also fostered collaborative and trusting relationships.

Note: This narrative is taken from a multiauthored manuscript currently in process entitled: *Working from Strength: Creating a Sustainable Transfer Experience across Institutions.* © 2012. All Rights Reserved.

Michigan Asks Key Questions

Henry Ford Community College, Macomb Community College, Oakland Community College, and Wayne State University

By Ahmad M. Ezzeddine

Wayne State University (WSU), a Detroit-based urban research university, has experienced significant changes in enrollment patterns in recent years. Declining population and an adverse economic landscape in Michigan have affected enrollment and retention of students. WSU began forging strategic partnerships with community colleges, and for the first time, the university's fall 2011 transfer enrollments exceeded its first-time first-year enrollments.

Supporting and facilitating the success of community college transfer students offers benefits and challenges to the university and the community college partners. Many units—academic, student services, and administrative—must collaborate, sometimes across and within very different contexts. Some lessons come the hard way. It quickly became evident that we needed a new transfer path model for a comprehensive, multilayered, and integrated approach to recruiting, educating, and supporting students.

The partnership is focusing effort on creating opportunities for strategic and operational collaborations. The aim is to develop a seamless transfer process and clear expectations for students transitioning between the community colleges and WSU.

Henry Ford Community College

Through our participation in AAC&U/PKAL Ramping Up for STEM Success project, the Michigan team found it useful to frame its activities by considering the following key questions:

ACCESS: What student and institutional barriers inhibit successful transfer and completion of STEM curricula?

SUCCESS: How do we ensure community college students are successful at WSU?

STUDENT ENGAGEMENT: How are we working together to create alignment in curricula and support to ensure student success?

COMPLETION: How do we create clear pathways that promote and facilitate the completion of STEM degrees?

WORKFORCE DEVELOPMENT: How do these efforts translate into employability?

EVIDENCE OF ACHIEVEMENT: Our team began monthly meetings in September 2011. Specific data-driven activities include

- Effectively launching WayneDirect, the university's concurrent enrollment initiative
- Implementing a STEM Certificate to satisfy the core courses for science and engineering degrees
- Expanding STEM articulation agreements
- Developing a reverse transfer process
- Developing a transfer student orientation
- Establishing a joint advising process
- Engaging with business and industry

Our team and leadership are committed to making this journey as we strive to speak in a common voice about *our* transfer students.

Texas Creates Reverse Transfer

El Paso Community College and University of Texas at El Paso

By Stephen Aley

El Paso Community College (EPCC) and University of Texas at El Paso (UTEP) are known as leaders in student-centered higher education partnerships. Nationally, UTEP ranks second in the nation both in awarding total bachelor's degrees to Hispanic students and also in awarding bachelor of science (BS) degrees in engineering and biological sciences to Hispanic students. Significantly, almost a third of STEM graduates at UTEP began as transfer students, with most of those coming from EPCC. Moreover, at least 80 percent of UTEP STEM graduates have some transfer course credit, with 68.5 percent

University of Texas at El Paso

of STEM graduates having course credit specifically from EPCC. To facilitate flexibility in degree planning for transfer students, EPCC and UTEP have also initiated a Reverse Transfer Agreement, allowing course credit from UTEP to fulfill residual requirements for associate level degrees at EPCC. The agreement has benefitted almost 2,500 transfer students in the past three years.

Through this teamwork we have demonstrated a substantial increase in STEM degrees awarded, ranging from 211 BS degrees in 2000–2001 to 572 (450 to Hispanic students) degrees in 2010–2011. This growth represents the highest growth in Hispanic STEM degrees in the nation.

Previous studies indicate that students who transferred from EPCC are more successful than transfer students from other institutions, and students with added transfer credits are more likely to persist and complete than those entering UTEP with fewer transfer credits. However, the data also indicate that students with more transfer credits can be at a disadvantage for efficient and timely completion of their BS degree as compared with nontransfer students.

Working in concert with other national teams in Ramping Up, we developed plans to extend our findings. We will coordinate data from both institutions to refine the model for transfer success and determine specific elements affecting baccalaureate attainment of our STEM students, including *when* students make the decision to major in STEM; *what* factors encourage them to persist in STEM; *what* is the role of advising at each institution; and *what* are the demonstrable benefits of academic/cocurricular alignment. Finally, we will better communicate successful practices and challenges to transfer student success, creating interinstitutional teams to author reports on existing transfer student initiatives in areas of collaboration between EPCC and UTEP.

Looking Ahead

What should next generation STEM transfer programs do? We have learned in the Ramping Up for STEM Success project that we need to

- ◆ Promote understanding that the context for STEM learning is just as important to student success as the content of STEM courses and majors. Essential work is needed to create integrated social supports for student success, with advising and support for diverse students as key components of this work.

- ◆ Define and monitor transfer success using an evidence-based approach, with clear metrics and data analytics, and develop mechanisms to share data across institutional partners and beyond.

- ◆ Develop a common core of competencies for cross-institutional, multidisciplinary STEM programs that will enable the creation of workforce-related, field-focused transfer pathways (as opposed to discipline-focused pathways) that address essential learning outcomes and not just content and match the demands of the workplace and twenty-first-century life.

- ◆ Build a community that is focused on transfer issues with respect to STEM programs, scaling up successful program and supporting innovations for implementation across states and regions.

- ◆ Share best practices in key areas of work: programmatic alignment and core competency development, student advising, bridge program development, student support programs, evaluation methods, mathematics preparation, cross-campus partnership building, policy and practice to find and fix transfer gaps, leadership to publicize the talents and assets that transfer students bring, and methods to address biases against transfer and transfer students wherever they occur.

- ◆ Recognize the workforce and citizenship value of graduates who are competent in diversity, global thinking, ethical reasoning, communication, and collaborative problem solving—values that employers seek.

Reference:
Carnevale, A.P., N. Smith, M. Melton. 2011. *STEM*. Washington, DC: Georgetown University Center for Education and the Workforce, http://cew.georgetown.edu/stem/.

About Project Kaleidoscope

Since its founding in 1989, Project Kaleidoscope (PKAL) has been one of the leading advocates in the United States for building and sustaining strong undergraduate programs in the fields of science, technology, engineering, and mathematics (STEM). With an extensive network of nearly 7,000 faculty members and administrators at over 1,000 colleges, universities, and organizations, PKAL has developed far-reaching influence in shaping undergraduate STEM learning environments that attract and retain undergraduate students. PKAL accomplishes its work by engaging campus faculty and leaders in funded projects, national and regional meetings, community-building activities, leadership development programs, and publications that are focused on advancing what works in STEM education. PKAL is now in partnership with AAC&U, building on a shared vision of shaping undergraduate learning environments that prepare all undergraduates to address the challenges they will face as leaders in the new global century.

The Association of American Colleges and Universities (AAC&U) is the leading national association concerned with the quality, vitality, and public standing of undergraduate liberal education. Its members are committed to extending the advantages of a liberal education to all students, regardless of academic specialization or intended career. Founded in 1915, AAC&U now comprises more than 1,250 member institutions—including accredited public and private colleges, community colleges and universities of every type and size.
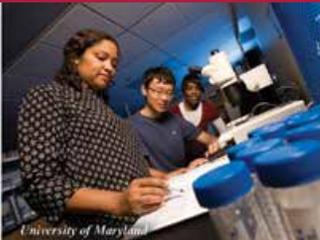
AAC&U functions as a catalyst and facilitator, forging links among presidents, administrators, and faculty members who are engaged in institutional and curricular planning. Its mission is to reinforce the collective commitment to liberal education at both the national and local levels and to help individual institutions keep the quality of student learning at the core of their work as they evolve to meet new economic and social challenges.

Information about AAC&U membership, programs, and publications can be found at www.aacu.org.

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AAC&U Working Conferences for 2012–2013

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Baltimore, Maryland
October 18–20, 2012

Next Generation STEM Learning:
Investigate, Innovate, Inspire

Kansas City, Missouri
November 8–10, 2012

General Education and Assessment:
A Sea Change in Student Learning

Boston, Massachusetts
February 28–March 2, 2013

Student Success and The Quality Agenda

Miami, Florida
April 4–6, 2013

Network for Academic Renewal
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