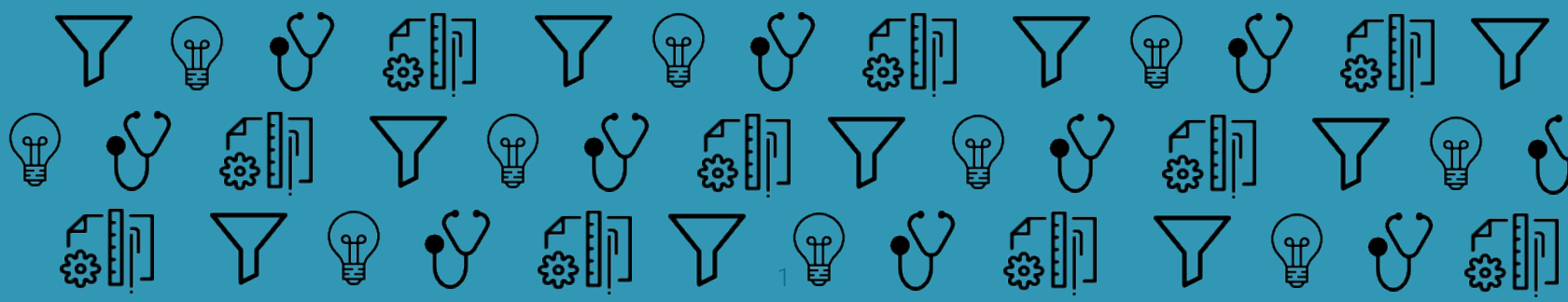The Campaign for
College
Opportunity

SPOTLIGHT
PRACTICE | Reading Apprenticeship
Community College STEM
Network

SEPTEMBER 2017

READING APPRENTICESHIP COMMUNITY COLLEGE STEM NETWORK

Improving community college student success in Science, Technology, Engineering and Math (STEM) gateway courses is critical to improving the nation's STEM career pipeline and to increasing the diversity within that pipeline.

Despite being one of the fastest growing job sectors in California, the proportion of community college students completing STEM majors is surprisingly low — for instance, in California, only 5% of Associate Degrees for Transfer awarded by the California Community Colleges in 2013–14 were in STEM majors. And disproportionate numbers of minority, low-income, and female students across the country do not complete community college STEM courses.

> "In California, only 5% of Associate Degrees for Transfer awarded by the California Community Colleges in 2013–14 were in STEM majors."

Overall, most students need more support from faculty and colleges and universities to do the kind of discipline-specific reading, thinking, and problem solving that completing a STEM degree requires. Each STEM course is considered essential to a students' ability to progress in the next course. Without instructional support, it is easy for students to fall behind and become discouraged.

While the benefit of active learning to engage in and master STEM concepts is well known in the field, instructors can find it difficult to use classroom time to set up active, inquiry based problem solving. They often feel that lecturing is the most efficient way to "deliver content" and doubt the value of taking time to help students work together to understand important concepts.

Photo Credit: PROCollegeDegrees360

Contributing to the problem are STEM texts, which are famously complex. If students can be taught to engage with course texts independently and collaboratively (rather than only relying on lecture notes or PowerPoint slides), they are much more likely to be able to study and prepare effectively outside of class and in future STEM courses. Unfortunately, as overwhelmed as students feel when faced with the "new languages" of chemistry, physics, math, etc., faculty also feel overwhelmed with the task of how to support the students' engagement with text.

To help STEM instructors address this challenge, the Reading Apprenticeship program at WestEd was created to provide intensive professional development through a grant-funded statewide professional learning network serving over 120 STEM instructors at 17 California community colleges. Rooted in the Reading Apprenticeship framework — a research-validated approach to improving content-area literacy — the STEM Network trains participating STEM faculty in proven strategies to support and improve their students' academic literacy and achievement.

READING APPRENTICESHIP FRAMEWORK

SOCIAL DIMENSION
» Creating safety
» Investigating the relationship between literacy and power
» Sharing text talk
» Sharing reading processes, problems, and solutions
» Noticing and appropriating others' ways of reading

PERSONAL DIMENSION
» Developing reader identity
» Developing metacognition
» Developing reader fluency and stamina
» Developing reader confidence and range

COGNITIVE DIMENSION
» Getting the big picture
» Breaking it down
» Monitoring comprehension
» Using problem-solving strategies to assist and restore comprehension
» Setting reading purposes and adjusting reading processes

KNOWLEDGE-BUILDING DIMENSION
» Surfacing, building, and refining schema
» Building knowledge of content and the world
» Building knowledge of texts
» Building knowledge of language
» Building knowledge of disciplinary discourse and practices

METACOGNITIVE CONVERSATION

EXTENSIVE READING

For instance, in the classroom of physics professor Lilit Haroyan of East Los Angeles College, small groups of students work together to solve physics equations. As they grapple with multiple texts and core concepts, Haroyan walks around the classroom and, rather than providing answers, questions her students in order to surface their thinking processes and push them to understand the materials.

Over time, through continued professional development in communities of peers, faculty develop their ability to implement these Reading Apprenticeship routines that build on their STEM expertise and push them to recognize the "invisible resources" (e.g. their own subject knowledge, context clues) they have for apprenticing students to the ways of making sense of STEM texts. For example, Diane Livio, a life sciences professor at Los Angeles Mission College, describes the way she uses two of Reading Apprenticeship's core routines, Think Aloud and Talking to the Text, and reflects on the difference these routines made for her students.

"I used 'Think Aloud' with my Bio 7 and Bio 3 sections in the first week of classes to introduce them to [strategies for] reading their textbooks. And, halfway into the semester, I had the Bio 3 lab sections do either 'Think Aloud' or 'Talking to the Text' with their lab manuals. Both my major and non-major students responded positively to the activities — some students told me it was helping them with their studying approach, and labs started off more smoothly afterward."

—Diana Livio, Professor, Los Angeles Mission College

DEFINITIONS

Think Aloud is a core Reading Apprenticeship routine that allows teachers and students to verbalize their thinking process for others as they read and make sense of new and unfamiliar texts. A teacher or student will read a text out loud in front of the class or with a partner and share their thoughts as they read. The reader will note connections to existing knowledge or any unfamiliar words. When the reader gets to a point of confusion, the reader will stop and talk through their thinking as they attempt to problem-solve the issue.

Talking to the Text is a silent, written version of Think Aloud. The reader makes notes on the text as they read, noting confusions, highlighting important ideas, identifying connections, and any recording any questions they may have.

Evidence of Positive Impact

The primary aim of the STEM network is to increase college retention and graduation rates of STEM students so more students from underrepresented populations are ready for globally competitive careers. To determine evidence of impact we look for increased rates of persistence and success for all students, and particularly minority and female student populations. Data collection is ongoing, but early reports have been promising. At Chaffey College, overall student retention rates have increased for three out of four instructors in Biology, Math and Computer Science. Student retention rates were particularly high in the two math courses, jumping from an average of 78.6% to 94.1%. Across all four courses, Hispanic students experienced an average of 8% increase in retention. Female students, often underrepresented in STEM fields also benefited from courses with Reading Apprenticeship.

Table 1: Latino students at Chaffey College saw the highest jump in retention rates after RA was introduced.

Impact Measure	Biology 61		Math 25		Math 425		Computer Science	
	Pre-RA	RA	Pre-RA	RA	Pre-RA	RA	Pre-RA	RA
Overall Retention	81.6%	**81.8%**	77.8%	**94.1%**	79.5%	**94.1%**	82.9%	81.8%
Latino Retention	78.3%	**80%**	88%	**92.3%**	75%	**86.4%**	81%	**94.4%**
Female Retention	80.8%	80%	66.7%	**100%**	81.8%	**100%**	50%	**57.1%**

Network faculty have found that student pass rates have also shown improvement after implementing Reading Apprenticeship. In one network math course, faculty reported that the student pass rate increased from 43% to 70%. While a biology instructor reported that 95% of students passed his courses after embedding Reading Apprenticeship.

"Collaborating with colleagues in my discipline around lesson planning showed me that we math faculty can work together to plan engaging lessons within the Reading Apprenticeship framework without it being a matter of sacrificing [instructional] time for content."

—STEM faculty participant at the 2016 STEM Winter Conference

Expanding Teaching Strategies to Better Support All STEM Students

Faculty and others intrigued by this work, have multiple opportunities--from online courses, to face-to-face seminars, to annual conferences-- to become part of this dynamic, growing professional learning community. For more information, contact our Reading Apprenticeship College Coordinator Nika Hogan at **mhogan@wested.org** or visit our website at **www.readingapprenticeship.org**.

History of the Reading Apprenticeship Community College STEM Network

The current Reading Apprenticeship STEM Network was nurtured through a partnership between WestEd's Reading Apprenticeship program and the California Community College Success Network (3CSN). Since 2011, 3CSN — with funding from the California Community College Chancellor's Office — has sponsored a statewide community of practice in Reading Apprenticeship, supporting professional learning opportunities for more than 2,000 community college educators across multiple disciplines. In 2014, the Leona M. and Harry B. Helmsley Charitable Trust awarded WestEd a three-year grant to launch a Reading Apprenticeship community of practice specifically STEM community college faculty. The Helmsley grant aims to increase the retention, academic success, and completion of California community college STEM students and to ignite widespread change initiatives based on Reading Apprenticeship.

In addition to the 17 campuses supported through the Helmsley grant, the Reading Apprenticeship STEM Network has generated numerous tools and learning opportunities, including an online introduction to Reading Apprenticeship for STEM faculty available for other STEM faculty across California and beyond.

17 CAMPUSES ARE SUPPORTED THROUGH THE HELMSLEY GRANT

CURRENT COLLEGES PARTICIPATING:

American River College

Cañada College

Chaffey College

College of San Mateo

College of the Canyons

Crafton Hills College

Cuyamaca College

East Los Angeles College

Foothill College

Fresno City College

Fullerton College

Los Angeles Mission College

Mission College

Pasadena City College

Santa Monica College

Skyline College

West Los Angeles College

STEM fields represented across Reading Apprenticeship Community College Network

- Algebra/Calculus
- Biological sciences
- Chemistry
- Engineering
- Environmental Science
- Nursing
- Physics
- Earth Sciences
- Statistics
- Computer Science
- Health/Nurtrition
- Other

Footnotes:

[1]National Research Council. (2012). Community Colleges in the Evolving STEM Education Landscape: Summary of a Summit. Washington, DC: The National Academies Press. Olson, S., & Gerardi, D. (2012). Engage to Excel: Producing One Million Additional College Graduates with Degrees in Science, Technology, Engineering, and Mathematics. Report to the President. Washington D.C.: President's Council of Advisors on Science and Technology (PCAST), Executive Office of the President.

[2]Campaign for College Opportunity. (June 2016). Needed: Sy(STEM)ic Response, How California's Public Colleges and Universities are Key to Strengthening the Science, Technology, Engineering and Math (STEM) and Health Workforce.

[3]Bailey, T., Jeong, D. W., & Cho, S.-W. (2010). Referral, enrollment, and completion in developmental education sequences in community colleges. Economics of Education Review, 29(2); Boroch, D. J., Hope, L., Smith, B. M., Gabriner, R. S., Mery, P. M., Johnstone, R. M., … Nixon, J. (2010). Student Success in Community Colleges: A Practical Guide to Developmental Education. San Francisco: Jossey-Bass; College Board. (2012). Report on College And Career Readiness 2012.

[4]Freeman, Scott, et al. "Active learning increases student performance in science, engineering, and mathematics." Proceedings of the National Academy of Sciences 111.23 (2014): 8410-8415

ABOUT THE CAMPAIGN

The Campaign for College Opportunity is a broad-based, bipartisan coalition, including business, education and civil rights leaders that is dedicated to ensuring that all Californians have an equal opportunity to attend and succeed in college in order to build a vibrant workforce, economy and democracy. The Campaign works to create an environment of change and lead the state toward effective policy solutions. It is focused upon substantially increasing the number of students attending two- and four-year colleges in California so that we can produce the 2.3 million additional college graduates that our state needs.

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