

Radford University

Radford, Virginia

As is the case nationwide, too many STEM students leave Radford University within their first year of college. Instead of blaming this attrition on the students, we transformed our uninspiring entry-level science curriculum and the cold social environment that greeted our students. Our REALising Inclusive Science Excellence (REALISE) program aimed to redesign the biology, chemistry, and physics curricula and provide a welcoming environment where students support each other and faculty communicate their belief that all students can succeed. Through inclusive pedagogy and a student-centered approach, we sought to alter the environments within which our students live and learn. Our three primary strategies for effecting change were investing in faculty professional development, focusing on student social supports, and utilizing our leadership team to advance cultural and structural change across the institution (see Figure 1).

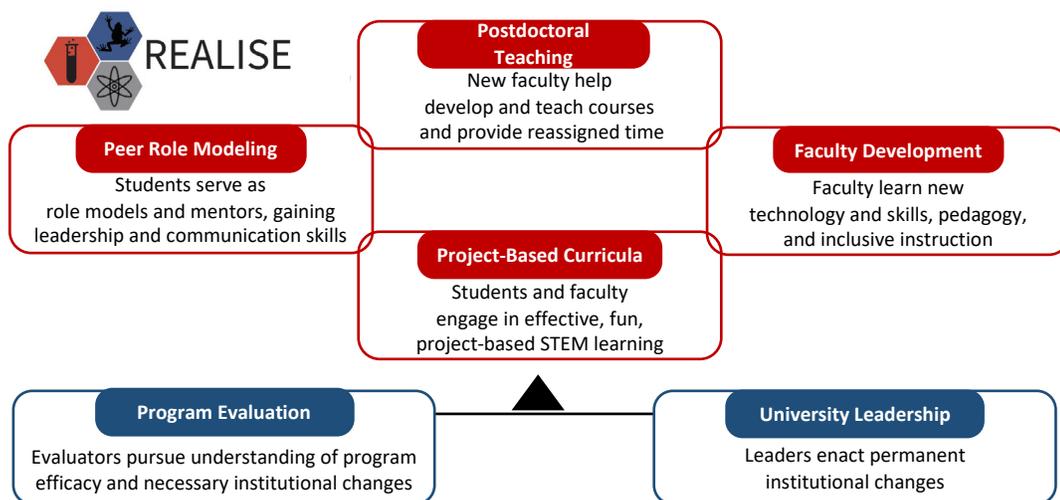


FIGURE 1: Overview of the REALISE program's structure.

Within the three focal departments, more than 75% of full-time faculty engaged in six faculty learning communities (FLCs) to learn and implement inclusive pedagogy strategies (e.g., disrupting microaggressions and implicit biases, engaging in project-based learning, raising cultural awareness, undertaking backward course design). REALISE postdoctoral fellows, hired in each department, provided reassigned time for full-time faculty and also participated in the FLCs and REALISE leadership. Importantly, the FLC training encouraged self-reflection and promoted adoption of a student-asset mindset. Assessment of the FLCs indicated that faculty now have more awareness of diversity and equity issues within their classrooms, which altered their teaching methods and approaches more toward building relationships with their students. Two workshops led by project-based learning (PBL) experts from Worcester Polytechnic Institute helped faculty build specific classroom projects. Now, revised syllabi communicate care for our students, faculty learn together through reading groups, and PBL is gaining traction in our STEM curriculum (several of our FLC and PBL outcomes are published). In the three departments during 2019, the rates at which students received grades of D or F or withdrew (DFW rates) from courses with REALISE-trained faculty were 12% lower than DFW rates in courses taught by non-FLC faculty. While the pandemic disrupted our progress, 2022 DFW rates in the required 100- and 200-level courses were 10% lower than in the years prior to the pandemic.

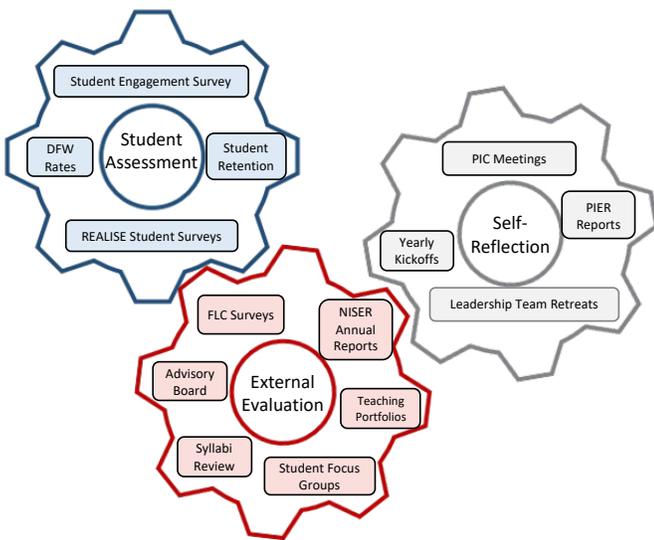


FIGURE 2: Evaluation and assessment for REALISE.

To overcome the barrier of faculty buy-in, the REALISE team championed tracking inclusive pedagogy on the university-wide faculty annual reporting system and worked with the new dean to require the use of inclusive pedagogical practices to earn tenure and promotion at the college level. Partnerships with the Center for Innovative Teaching and Learning (CITL), as well as with non-STEM faculty with specific expertise (i.e., team-based learning or cultural awareness), were critical to the success of the REALISE FLCs. In parallel, faculty development offerings were shifting to embrace inclusive pedagogy; this is changing how faculty think, act, and invest their resources. Utilizing an external advisory board of experts in PBL and inclusive pedagogy, working with the National Institute of Science Education and Research (NISER) as an external evaluator, and creating opportunities for leadership team reflection were critical to continually reevaluating our efforts toward advancement of IE (see Figure 2).

Program Goal	Event/ Initiative	Description
STRENGTHEN SCIENCE IDENTITY 	Imposter Syndrome Seminar	Dr. Devin Swiner spoke about her scientific journey as a woman of color and shared definitions of types of imposter syndrome, the different ways it can present, and how to overcome it. (10-50 students per event)
	Diversity in STEM Series	Diverse groups of career scientists met with students as a virtual panel and in-person roundtables to discuss their experiences in STEM and answer questions. (10-30 students per event)
	Artis Student Panel	Third- and fourth-year students from each STEM major answered questions about study habits, school-life balance, overcoming barriers, and other facets of their experience at Radford University. (30-40 students per event)
	Classroom Visits	Faculty hosted REALISE PRMs in their classes to talk to new students about their college experience and answer questions. Some visits were general Q&As, while others were focused on a specific topic, like undergraduate research. (5-15 visits per semester)
BUILD STEM COMMUNITY  	Tie-Dye	Students spend time with REALISE PRMs and other peers while tie-dyeing a REALISE T-shirt or mask. (40-70 students per event)
	Fresh Fruit Fridays (FFF)	Every Friday morning free coffee, breakfast, and snacks are shared to help combat food insecurity on our campus. REALISE PRMs interact with students throughout the event to help build connections. Faculty also host office hours during the event. This event was extremely popular and spread to other colleges/units on campus until there was a similar event for every day of the week. (30-100 students per event)
	Paint & Plant	Students meet REALISE PRMs and other peers while painting terracotta pots. The REALISE Students collaborated with Plant Club so students could also pick out a plant to take home. (30-50 students per event)
	STEM Club Fair	REALISE Students invited all STEM-based student clubs to participate in a college-specific club fair. Students could meet members from each club and participate in a club-related activity. For example, the REALISE PRMs helped students make science and motivational buttons. (10-50 students per event)
AMPLIFY STUDENT VOICE 	Student Surveys	REALISE Students distributed online surveys about classroom comfort and office hours accessibility. The students then analyzed the data and created informative visuals for faculty.
	Fresh Fruit Friday Polls	A different poll question was written on a whiteboard during FFF each week. These questions often revolved around students' well-being and ideas for future REALISE events.

Student social support was provided by what we called REALISE Students, peer role models (PRMs) whose goals were strengthening science identity, building STEM community, and amplifying student voices (see Figure 3). With close faculty mentorship, PRMs were trained to handle difficult conversations and create inclusive communities. One of our signature events, Fresh Fruit Fridays, catalyzed the creation of a network of free breakfast events each day of the week across campus. The REALISE Students flourished during the grant and elected to become a student club at the end of the funding period. However, this transition was not successful; we learned that compensation for student time is imperative for running an extensive PRM program. Currently, we are exploring utilization of work-study positions and other special funds to revive and continue the PRM program.

FIGURE 3: REALISE Peer Role Model events and engagement.

The presence of REALISE created additional opportunities to advance cultural and structural change across the institution (see Figure 4). REALISE catalyzed two other grant programs: Engaging Differences, funded by our HHMI Faculty Forums on Race grant, and Elevate Research, funded by the Jessie Ball duPont Fund. Engaging Differences aimed to increase awareness, knowledge, and changes in practices by program participants – faculty and institutional leadership – that resulted in specific actions leading to a more welcoming and supportive climate for our racially minoritized campus populations. The Elevate Research program aimed to increase and diversify the number of students participating in research and creative inquiry, to close equity gaps in retention and graduation rates, to support faculty who develop course-based undergraduate research experiences (CUREs), and to increase BIPOC classroom leadership. Finally, REALISE faculty development and student social support will be scaled up via our five-year institutional quality enhancement plan called RISE (Realizing Inclusive Student Excellence). The RISE program uses a data-driven approach and aims to increase student success in required 100- and 200- level courses, as well as to increase student academic success and sense of belonging in college. The hiring of an educational developer for inclusion and belonging, a new permanent CITL staff member, through the RISE program was an important win in terms of our ability to institutionalize inclusive excellence.

We have been intentional, strategic, and opportunistic in our efforts to alter the environments within which our students live and learn – attending to culture, structure, and the political landscape. Our REALISE leadership team included individuals at the provost and dean levels, both junior and senior faculty, and the program's postdoctoral fellows. This positionally diverse group gave us access to different institutional levers, resources, and spheres of influence to keep advancing our work; this was critical, given administrative turnover. We incentivized people and activities, aligned with our partners' priorities and supported their initiatives for mutual gain, leveraged the strategic plan, and made connections across the university. Our thinking evolved over time as institutional leadership and personnel shifts created opportunities to advance some strategies and limited advancement (or even access) in other areas.

We learned several crucial lessons about building institutional capacity for IE. First and foremost, this work is hard and requires significant emotional labor. As progress is made, pushback increases. As such, taking care of one another as humans is always important – and becomes

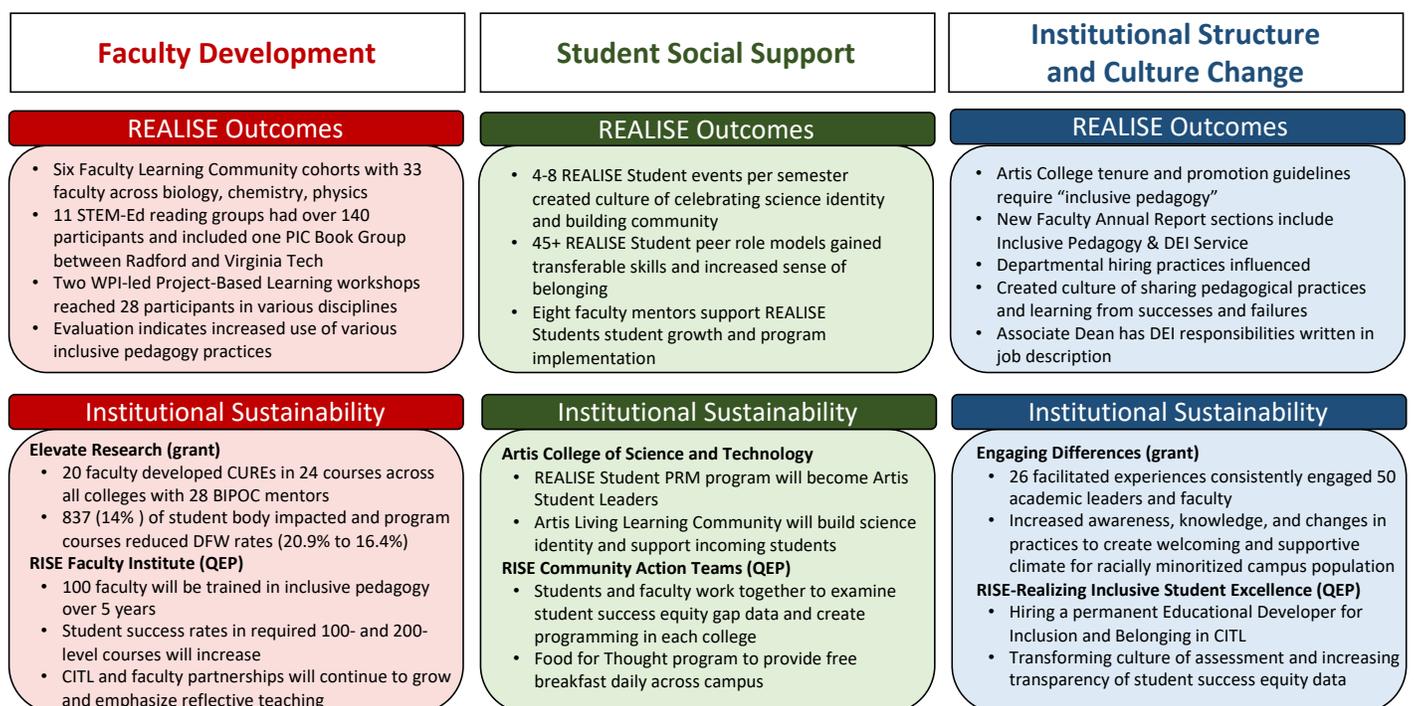


FIGURE 4: Highlights of REALISE outcomes and the institutional sustainability of faculty development, student social support, and institutional structure and culture change.

increasingly so as the work advances. Second, seeding change in multiple institutional locations and using different levers to advance the work helps the project maintain forward momentum when environments shift – and they will. Third, keep the end goal in mind and remain flexible in your approach and priorities.

Grant-Derived Dissemination Products

Publications

Wojdak, J., Phelps-Durr, T., Gough, L., Atuobi, T., DeBoy, C., Moss, P., Sible, J., and Mouchrek, N. (2020). "Learning Together: Four Institutions' Collective Approach to Building Sustained Inclusive Excellence Programs in STEM" in *Transforming Institutions: Accelerating systemic change in higher education* (book). <http://openbooks.library.umass.edu/ascnti2020/chapter/wojdak-et-al/>

Stefaniak, K.R., Winfrey, M.K., Curtis, A.C., and Kennedy, S.A. (2021). "Implementing an Iterative and Collaborative Approach to Inclusive First-Semester General Chemistry Laboratory Redesign," *Journal of Chemical Education*, 98: 340-349. DOI: 10.1021/acs.jchemed.0c00487

Balija, A.M. (2020). "1H NMR Spectroscopy Guided-Inquiry Activity Using the NMR Spectrometer: Incorporating Student-Generated Videos to Assess Learning," *Journal of Chemical Education*, 97: 1387-1390. DOI: 10.1021/acs.jchemed.9b00693

Lau, J.K., Paterniti, M., and Stefaniak, K.R. (2019). "Crossing floors: Developing an interdisciplinary CURE between an environmental toxicology course and an analytical chemistry course," *Journal of Chemical Education*, 96: 2432-2440. DOI: 10.1021/acs.jchemed.9b00289

Kennedy, S.A., Balija, A.M., Bibeau, C., Fuhrer, T.J., Huston, L.A., Jackson, M.S., Lane, K.T., Lau, J.K., Liss, S., Monceaux, C.J., Stefaniak, K.R., and Phelps-Durr, T. (2020). "Faculty Professional Development on Inclusive Pedagogy Yields Chemistry Curriculum Transformation, Equity Awareness, and Community," *Journal of Chemical Education*, 99: 291-300. DOI: 10.1021/acs.jchemed.1c00414

Lau, J., Mekolichick, J., Raimer, A., and Kennedy, S. (publication anticipated in 2023). "Assessing changes in student engagement using a mixed-methods approach" in *Fostering Communities of Transformation in STEM Higher Education: A Multi-institutional Collection of DEI Initiatives* (book).

Raimer, A., Stefaniak, K., and Liss, S. (publication anticipated in 2023). "Creating impactful moments: Using peer-role models to build community and sense of belonging in STEM" in *Fostering Communities of Transformation in STEM Higher Education: A Multi-institutional Collection of DEI Initiatives* (book).

Mekolichick, J. (publication anticipated in 2023). "Institutionally advancing inclusive excellence: Leading from the middle in times of transition" in *Fostering Communities of Transformation in STEM Higher Education: A Multi-institutional Collection of DEI Initiatives* (book).

DeBoy, C., Gough, L., Kennedy, S., Raimer, A., and Sible, J. (publication anticipated in 2023). "From the soul: Learning and leading together toward inclusive excellence" in *Fostering Communities of Transformation in STEM Higher Education: A Multi-institutional Collection of DEI Initiatives* (book).

Huston, S., Herman, R., Liss, S., and Taylor, B. (publication anticipated in 2023). "Community, curriculum, and CUREs: Transformations in the physics department at Radford University" in *Fostering Communities of Transformation in STEM Higher Education: A Multi-institutional Collection of DEI Initiatives* (book).

Presentations and posters

Phelps-Durr, T.L., Mekolichick, J., Rogers, J.O., Wojdak, J.M., and Kennedy, S.A. "Year 1 progress on HHMI Inclusive Excellence at Radford University," HHMI IE Peer Implementation Cluster (PIC) meeting, Trinity Washington University, Washington, D.C., May 2018.

Phelps-Durr, T., Rogers, J.O., Kennedy, S., Mekolichick, J., and Wojdak, J. "Realising Inclusive Science Excellence (REALISE) at Radford University," Council on Undergraduate Research (CUR) biennial conference, Arlington, Va., July 1-3, 2018.

Taylor, B.E. (presenter) and coauthors Phelps-Durr, T., Rogers, J.O., Mekolichick, J., Herman, R.B., Huston, S.M., Freed, M.S., Anderson, J.R., Small, C.J., Sheehy, R.R., Redmond, S.B., and Wojdak, J.M. "Adding Undergraduate Research in a Backwards-Designed Curriculum," CUR biennial conference, Arlington, Va., July 1-3, 2018.

Rogers, J., Phelps-Durr, T., Mekolichick, J., Wojdak, J., and Kennedy, S. "Achieving Inclusive Excellence by Embedding Project-based Learning into First-year Courses," American Association of Colleges and Universities (AAC&U) Transforming STEM Higher Education conference, Atlanta, Ga., November 8-10, 2018.

Kennedy, S., and Curtis, A. "Using the lens of inclusive excellence to redesign and assess the general chemistry laboratory experience," American Chemical Society (ACS) national meeting, Orlando, Fla., April 2019.

Curtis, A., Kennedy, S., and Mekolichick, J. "Assessment of Students' Sense of Belonging, Science Identity, and Self-Efficacy to Measure the Effects of Inclusive Excellence Initiatives," HHMI PIC meeting, Blacksburg, Va., June 6, 2019.

Stefaniak, K.R., Lau, J.K., Herman, R.B., and Phelps-Durr, T.L., "Creating Inclusive Classrooms through Project-based Learning," Teaching and Learning conference, Elon University, Elon, N.C., August 15, 2019.

Kennedy, S.A., and Winfrey, M. "Curricular reform in light of inclusive pedagogy: Faculty development and student support," ACS national meeting, San Diego, Calif., August 2019.

Taylor, B.E., Herman, R.B., Liss, S., Rutkowski, T.C., Jaronski, W.S., Huston, S.M., Freed, M.S., and Watts, L.T., "Radford University – Physics Year 3 Update and Successes," CUR Transformations Project, Rice University, Houston, Tex., October 5, 2019.

Mekolichick, J., and Kennedy, S. "Institutional change toward inclusive excellence: Case study & conversation," AAC&U, Chicago, Ill., November 7-9, 2019.

Firebaugh, A., Phelps-Durr, T.L., and Mekolichick, J., Kennedy, S.A., Herman, R.B., Rutkowski, T.C., and Jackson, M.S. "STEM Peer Role Models Build Strong, Sustainable STEM Communities," AAC&U Transforming STEM Higher Education, Chicago, Ill., November 7-9, 2019.

Rutkowski, T.C., and Herman, R.B., "Project-Based Learning in Physics – Seeing the Physicist Within," AAC&U Transforming STEM Higher Education, Chicago, Ill., November 7-9, 2019.

Mekolichick, J., Jones, S.B., Penven, J., Lovelace, L.S., and Corey, D. "Leveraging Resources, Building Alliances, and Creating Capacity for Change," AAC&U Diversity, Equity, and Student Success, New Orleans, La., canceled due to COVID but scheduled for March 19-21, 2020.

Kennedy, S., and Winfrey, M. "Inclusive pedagogy toolkit for chemistry curriculum delivery," ACS national meeting (virtual), August 2020.

Raimer, A.C., Jackson, M.S., Lau, J. "REALising Inclusive Science Excellence (REALISE): Changing the Ways in which Students Perceive Their Science Identity and Sense of Belonging," AAC&U (virtual), November 4-6, 2021.

Kennedy, S., and Elkins, K. "Challenges and Successes on the Road to Inclusive Excellence in Chemistry," ACS national meeting, March 22, 2022.

Raimer, A.C. "Building STEM Identity and Community through Peer Mentoring," Luce Colloquium on Inclusive Excellence (virtual), April 21-22, 2022.

Foltz, S., *McLaughlin, J., Mekolichick, J., Monceau, C., Raimer, A., *Richard, G. (*student presenters). "Reflection on Radford's REALISE Program," HHMI IE PIC meeting, Towson, Md., June 2, 2022.

Raimer, A.C., and Kennedy, S.A. "REALising Inclusive Science Excellence (REALISE) Student Peer Mentoring: Building Community, Identity, and Belonging within STEM," AAC&U, Arlington, Va., November 3-5, 2022.

DeBoy, C.A., Gough, L., Raimer, A.C., Sible, J.C., and Kennedy, S.A. "Sustaining Inclusive Excellence through Communities of Practice", AAC&U, Arlington, Va., November 3-5, 2022.

Fox, J., Herman, R., Kennedy, S., Lau, J., Mekolichick, J., and Raimer, A. "REALISE Project Successes and Challenges," HHMI IE PIC meeting-Big PIC, Radford, Va., June 1, 2023.

Stefaniak, K., Kennedy, S., and Raimer, A. "REALISE Student peer mentoring: Building community, identity, and belonging within STEM," ACS meeting, March 2023.

Grants

Mekolichick, J., Wirgau, J., Keith, H., Hill, B., and White, P. \$102,000 from the Jessie Ball duPont Fund for the Elevate Research Program ("The Retention-Based Practice of Course-Based Undergraduate Research Using Student Research Mentors on Black, Indigenous, and People of Color Students"), 2020.

Mekolichick, J., Jones, S., and Keith, H. \$25,000 from the HHMI Faculty and Staff Forums on Diversity and Inclusion Initiative for the "Radford University Engaging Differences Program," 2019.

Kennedy, S., and Elkins, K. (of Towson University). a \$6,500 Innovative Project Grant for Divisional Enhancement from the ACS Committee on Divisional Activities for "Inclusive Excellence in Chemical Education" (to host symposia at national ACS meetings), 2019.