Estrella Mountain Community College

Public Interest Technology Case Studies

Estrella Mountain Community College

Estrella Mountain Community College (EMCC) in Avondale, AZ, is one of ten Maricopa Community Colleges (MCCCD). MCCCD is one of the largest and oldest community college districts in the United States. EMCC is a Hispanic Serving Institution (HSI), currently enrolling more than 15,000 students in more than 100 degree and certificate programs. EMCC has specialized facilities for training students to enter manufacturing, energy, and healthcare industries.

EMCC is primarily a learning college, with a mission "to facilitate learning with every student, through every interaction, and by whatever method is most effective." EMCC has pursued this mission by increasing the graduation rate of students, as well as decreasing the amount of time to complete a degree. The college is also committed to diversity and inclusion, which are part of its core values and are reflected in EMCC's outreach to high schools in the area and the diversity of students who enroll. Furthermore, it aims to create a sense of place that expresses the historical and cultural values of the surrounding communities. Approximately 43% of students enrolled declare being transfer students with the intention to transfer to a university after completing their core requirements.

Students at EMCC can opt to take a 2-year associate's degree, or simply take courses that are eligible as transfer credits; in this latter case, students need to declare the courses as university transfers. There are a number of degrees, courses, and programs related to Public Interest Technology (PIT). Courses such as "Introduction to Programming Language" and "Survey of Computer Information Systems" in the computer science program both include a variety of ethics components, and their curricula are often linked to issues of public domain. Programs such as "Global Solutions," an intercultural exchange program connecting EMCC students with Middle Eastern students, or the laptop loaner program, which gives students the ability to borrow laptops for the duration of their studies, are also related to PIT. EMCC is a Title V institution, a federally funded program of the Higher Education Act (HEA) of 1998 that assists colleges and universities to improve higher education for Hispanic students. Through Title V funds, EMCC has various programs that focus on justice issues as they relate to technology, and in particular making technology accessible to various underserved communities. There are also several associate degrees that are relevant to PIT, such as computer information systems, information technology, and artificial intelligence.

Given this background, we have classified the two case studies under one or more of the following themes: learning, operations as well as Justice, Equity, Diversity, and Inclusion (JEDI).

Learning

PIT learning is about training future leaders to tackle the next century's socio-technical challenges while advancing public values like sustainability, justice, human health, and the well-being of the planet and all of the creatures that live on it. PIT learning explores new ways of transmitting knowledge to diverse audiences according to their needs and priorities. It also develops the hard and soft skills needed to bring about positive change, creating solutions that will promote the public good, rather than (or in addition to) the private interest. PIT learning programs may be formal or informal, facilitating

ends-oriented academic pathways and empowering tinkerers to create a rich PIT ecosystem of curricular and co-curricular programs. Key to such programs is promoting interdisciplinarity across STEM, the social sciences, the arts, humanities, and the professions.

JEDI

Public interest technology JEDI means centering and advancing Justice, Equity, Diversity, and Inclusion efforts pertaining to PIT activities across the university. By justice, we mean dismantling barriers to resources and opportunities in institutions, so that students, faculty, staff, and the community at large can live a full and dignified life of learning. By equity, we mean allocating resources to ensure that everyone has equal access to these opportunities from an institutional perspective. By diversity we mean removing barriers to ensure equal opportunities across race, gender, class, religion, disability, LGBTQ+ identity, and other potential differences and, more, acknowledging and celebrating such differences. By inclusion we mean amplifying the voices and perspectives of those who experience more obstacles due to their identities. JEDI can be enhanced across these four other categories of PIT by creating a culture of reciprocity to ensure the public good.

Operations

Public interest technology operations provide institutional support for the development of PIT activities and incorporate PIT into institutional missions by reflecting on the role of the institution as a user and maker of technologies, creating PIT-inspired policies and procedures, and working toward PIT ideals across the full spectrum of institutional activities. Institutions of higher education have an important role as developers, procurers, and deployers of technologies, and they should thus maintain internal processes to assure that they protect the public interest. In much the same way institutions of higher education change their practices as well as their curriculum to address sustainability challenges, they should do the same with respect to PIT.

Three components of operations are:
- Policies and procedures: Clear institutional guidelines to support PIT through logistical, financial, operational, and other approaches, as well as metrics that might clarify and improve these approaches.

- Procurement and deployment: Reflexive understanding of what is appropriate to ensure the interests of the institution's community - students, faculty, and staff - are supported when the institution makes decisions involving the purchasing and deployment of new technologies and systems.

- PIT ideals: Clear expression of and commitment to PIT ideals across the wide array of institutional functions, working to unify the institution's interest and the public interest.

Learning

Associate's Degree in Applied Sciences in Cybersecurity

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How the program fits the learning theme

There is a need for associate's degrees and certificates that are able to train students quickly, and in an affordable manner, to work in jobs that are in the public sector. Some of these jobs include, but are not limited to, building secure information and infrastructure systems and building utility infrastructures that are more secure. For this reason, EMCC offers an associate's degree in cybersecurity.

Program description

The Associate in Applied Science (AAS) in Cybersecurity is a two-year program, designed to build the necessary skills to secure, protect, and identify vulnerabilities in a network, including various operating systems and network devices. Students gain an understanding of the theory and practical aspects needed to maintain security on various networks and servers, as well as related legal and ethical issues. Many of the specializations of the program focus on industries that cater to the needs of various government sectors. The program also trains students in a variety of specializations such as Cybersecurity Fundamentals, Linux System Administration, Microsoft, Cisco Networking CCNA Security, and Critical Infrastructure. Glen Olson, the primary faculty member and curriculum developer for the critical infrastructure specialization, says that he sees these courses as being in the public interest, since students learn about the operational technologies needed to manage critical infrastructure such as water utilities, electricity grids, and traffic controls.

Program details

The associate's degree requires 61-74 credits to be completed. Students learn a range of concepts and skills, including cyber defense tools and methods. Students learn techniques and protocols to maximize security in the network. They are also engaged in understanding the moral, behavioral, ethical, and legal ramifications in the cybersecurity world. As a result, they learn about the regulatory and legal requirements to ensure compliance.

One of the core courses offered in this program is "Ethics in Information Technology." In this course, students learn about the ethical issues and responsibilities that come with working in computer science. They understand many of the public interest-related complexities of this field, which include corporate responsibility, government regulations, intellectual property, internet crime, identity theft, and employee surveillance, and they explore the ethics they should apply to their future work.

Students can choose from four specializations: Red Hat Linux system administration, Microsoft system administration, Cisco system administration and security, and critical infrastructure. The critical infrastructure specialization is well-aligned with PIT, as students learn about the interfaces found in a variety of government and private sector facilities, including homeland security, water infrastructure, energy grid, and traffic control, to name a few. Some of the courses taken in this specialization include:

"Introduction to Critical Infrastructure Protection." The history of critical infrastructure protection and its ties within the Department of Homeland Security are analyzed, with a focus on risk management associated with various sectors as well as the laws and standards developed to protect critical infrastructures.

"Introduction to Operational Technologies." Students learn the differences between Operational Technology (OT) and Information Technology (IT). The course focuses on the components and uses of an OT system, as well as the inherent threats, physical and cyber, related to an OT system.

"Introduction to Smart-grid Technologies." Students learn the differences between control systems, used to control physical and computer information systems, and those used to process data, particularly for the power and utility industry. The course covers system elements, functions, and security risks.

Program history

Courses and certificates offered within MCCCD are proposed and developed by the individual colleges, with approval through a process at the district level. Under the Guided Pathways program, each school has a representative who sits on a committee for each pathway. This arrangement ensures that course offerings within the degree path are transferable between schools. The cybersecurity guided pathways process identified a core set of classes that would be offered by all colleges. School representatives decided that, within this core, ethics would be a primary focus. As such, a specific "Ethics in IT" course is a prerequisite for many of the other courses in the pathway.

Outputs and outcomes

According to Mr. Olson, there is a gap in the market in operational technologies of critical infrastructures and no specialized programs to teach this field. Therefore, having this specialization allows EMCC to prepare students to be valuable contributors in the workforce. EMCC is a nationally recognized Center of Academic Excellence (CAE) for 2-year schools in Cybersecurity Defense Education by the National Security Agency and the Department of Homeland Security. This designation is only offered to two institutions across Arizona for 2-year programs. It is awarded to institutions for having high standards of learning, as well as for acting as a hub for raising awareness on issues of cybersecurity through the presentation of national and international speakers. Finally, students from this program have been involved in a number of activities and events, including hosting the North American Cybersecurity Alliance (NACRA) (https://www.actraaz.org/nacra). These events are geared at encouraging more students to get involved in understanding cybersecurity threats and learn how to deal with them in an ethical manner.

Limitations

An overall challenge of the community college is getting students to complete their degree in a timely fashion. First, even if students do complete their degree, many will not do so within the intended two-year timeline. Second, some students prefer not to declare completion as that may affect financial benefits, for example, Veterans Administration education benefits.

The pandemic has also greatly impacted the learning environment of this very hands-on program. The virtual learning environment imposed by the pandemic response has hindered students who need to be working within laboratory settings.
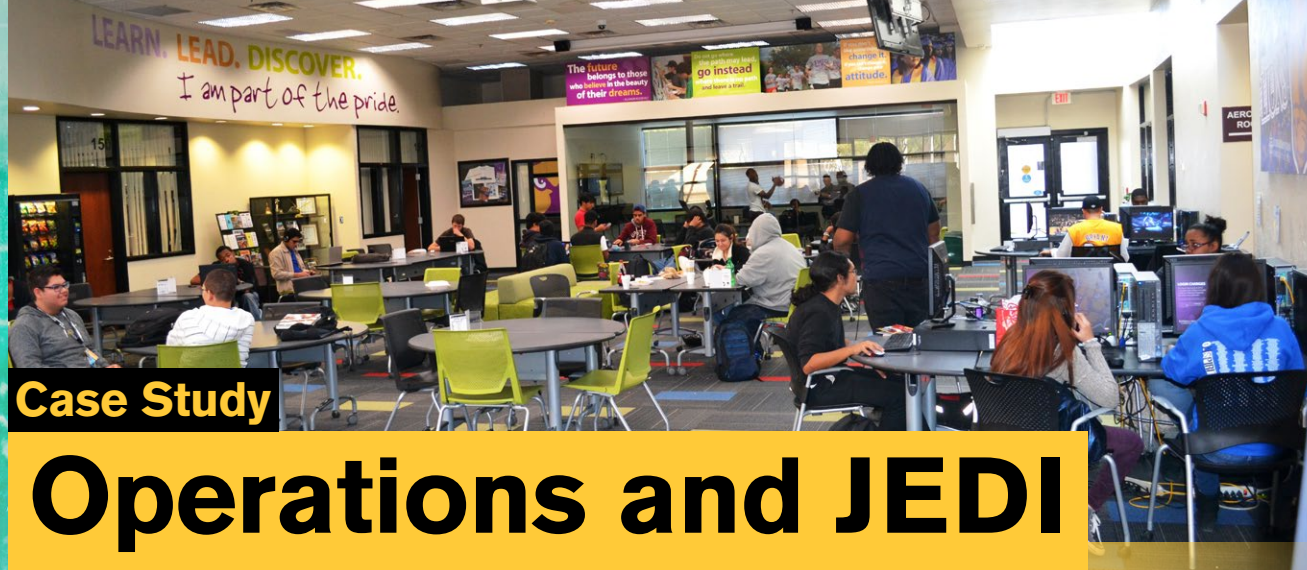
Operations and JEDI

Title V

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How the program fits the operations theme

Public Interest technology (PIT) activities should transpire across the activities of an institution, including within the operations of its own campus, in order to "walk the talk." At EMCC, this imperative is particularly well-exemplified in its work around Title V, especially since 2020 with EMCC's focus on Diversity, Equity, and Inclusion (DEI).

Program description

EMCC has been a recipient of Title V grants, offered by the Department of Education to support the development of Hispanic-Serving Institutions (HSI). An institution needs to be eligible and designated as a HSI to receive these grants. The program provides assistance to improve the attainment of, and expand educational opportunities for, Hispanic students. These grants also enable HSIs to expand and enhance their academic offerings, program quality, and institutional stability.

At EMCC, there are two main projects taking place at the moment: a fund for embedding advisors in high schools, and a research project with the Office of Planning and Institutional Effectiveness (OPIE) to develop and implement metrics to advance equity and inclusion. These efforts have also spawned a number of sub-projects.

Program details

While there are several different Title V projects, the two most closely aligned to PIT are the high school advisors and OPIE ones:

1. Title V has funded 2 high school embedded advisors, who engage high school students from underserved communities, offering programs such as dual-enrollment, Saturday programs Achieving a College Education (ACE), Hoop of Learning for Indigenous students, and STEM bridge programs in collaboration with Arizona State University.

2. OPIE Research projects, which are run by Dr. Elizabeth Cantu, Dr. Linda Manning, and Dr. Erica Wager, use research to identify equity achievement gaps between students of color and other students.

The research has shown that the gap is similar to national trends, and it finds that Black and African American students tend to have lower success outcomes than other demographics. This research has spawned a number of sub-projects, e.g.:

a. Creating a curriculum on culturally relevant pedagogy that is embedded in Canvas for lectures across the college, including STEM fields. These are plug-and-play activities that tackle various cultural issues from micro-aggressions to cultural bias.

b. Creating diversity, equity, and inclusion folders for all of EMCC's various dashboards. These dashboards are meant to help identify who is not being properly served at EMCC, and therefore assist in making adjustments as they progress.

c. The creation of a college-wide DEI committee with representation from faculty, the provost, and the vice president of academic affairs to tackle issues of diversity, equity, and inclusion from the various curricula to Human Resources.

History

Starting in 2008, EMCC has been receiving Title V - Developing Hispanic-Serving Institutions Program grants to support the Hispanic and Black communities in the college. In 2016, after an extensive review process, it received a 5-year grant of $2.6 million. To date, such grants have been used in a number of activities in the following PIT-related activities:

Learning College Summits: Starting in 2008, EMCC team members attended the League for Innovation Learning College Summit, focusing on themes such as academic early alert, campus-wide student engagement, and pedagogy.

Accreditation: Beginning in 2009, EMCC has been working on becoming accredited; the process was approved in 2012.

Student Success Measures: Using best practices and current research, EMCC implements programs to enhance student success, through research-based measures, with a focus on graduation goals.

In 2016, EMCC received the Placement, Pathways, and Prevention grant, which it designed to achieve the following goals: 1) reduce the number of students placed in developmental education; 2) accelerate the time students take to successfully complete developmental and related college-level courses; 3) increase timely graduation rates for Hispanic and all students; and 4) increase the college endowment to support student scholarships.

Embedded Tutoring program: Launched in the spring of 2018, this program "embeds" a tutor in either Math or Bio classes (considered gateway courses) to improve student success and support student learning and engagement. Overall, student success outcomes have been higher in currently supported classes compared to non-supported classes.

Outputs and outcomes

An important outcome for Title V grants is to institutionalize programs and activities that can demonstrate positive impact on access, success, and graduation rates for Hispanic and other minority student populations at HSIs. EMCC has been successful at mobilizing various funds over the past decade to support High School Embedded Advisors, PALS (Personalized Allies for Learning Success), Embedded Tutoring, and DEI and culturally relevant pedagogy training projects. Positive results have been seen with at least some of these projects, for example, student success outcomes have been higher in courses supported by Embedded Tutoring (MAT 114, BIO 156, BIO 181, and BIO 201), compared to non-supported classes. An equity analysis shows that Embedded Tutoring has particularly benefited first-generation students, as well as students who identify as Hispanic and as female. These results are significant given EMCC's student demographics, which are 63% first generation, 55% Hispanic, and 63% female.

Limitations

Some of the limitations of the work are related to resource needs. EMCC is building capacity in terms of assessment tools and technical infrastructure (dashboards). Additional and updated digital resources are needed to enable better tracking/support of students and increased student engagement with resources, as their students have to juggle college with work and family responsibilities.

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