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Engagement in Practice: the Student Engagement Continuum (SEC) – Opportunities and Challenges for a Sustainable Pipeline Enhancement Model at an Urban Institution

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Engagement in Practice: The Student Engagement Continuum (SEC) - Opportunities and Challenges for a sustainable pipeline enhancement model at an urban institution

Introduction

Virginia Commonwealth University (VCU), located adjacent to the historic Richmond downtown, recognizes its role in a culturally diverse Richmond region. VCU is a comprehensive institution with nearly 32,000 students and is recognized for its "Community Engagement" and "Highest Research Activity" according to Carnegie Classification of Institutions of Higher Education [1]. As the 4th largest academic unit on VCU's campus, the School of Engineering is comprised of 2,000 students with demographics that reflect the diverse community in which it serves. The development of collaborations such as public-private partnerships and projects with local communities has been VCU Engineering's essential ingredient for talent development, not only because of well-established relationships with the business community, but also because these community partnerships give way to a continuum of college-bound students that translates into a sustainable diverse STEM pipeline. The desire to expand the number of public-private partnerships within the local community, however, presents both opportunities as well as challenges. The VCU School of Engineering's position is that the positive impact on the communities and the families within those communities far outweighs the obstacles that are encountered. In this paper, the approach towards a highly-coordinated student engagement continuum in an urban setting is presented, along with preliminary findings of the opportunities and obstacles faced by the community as well as the institution.

The Student Engagement Continuum

Developing a sustainable, diverse pipeline of STEM students has become a national priority as part of a broader approach for maintaining US global competitiveness [2]. A diverse STEM workforce stimulates the economy, creates enabling technology that drive innovation (as measured by patents), and also develops solutions that improve quality of life. Producing a sufficient number of diverse STEM graduates who are prepared for STEM occupations serves as a key local economic driver. This amplifies efforts to serve the community, part of the university's core mission, through the broadening of university support within the surrounding neighborhoods. As pillars of the community, universities maintain a prominent role in STEM pipeline development that span across multiple dimensions [3], and this obviously includes increasing public awareness about STEM. To be more specific, universities must create campuses that are supportive and inclusive not only in regard to their own students but also in relation to interactions with outside individuals and entities. This requires institutional practices that are responsive and consistent across the institution and that intentionally recognize those in the surrounding community as valued and necessary stakeholders. While this is a model scenario and sounds like a good idea, it is more difficult to accomplish than one would anticipate. Assuming most educational environments are supportive and inclusive, there is convincing evidence (projected increases in STEM workforce versus projected STEM job outlook) [4] that supports the development of an unbounded student engagement continuum that funnels more college-ready students into STEM disciplines. A student engagement continuum, which we

describe as a holistic approach to student learning, would open up opportunities for teachers, community leaders, university professors and business leaders to work collaboratively together to develop and leverage learning innovation that is transferrable and scalable. In this work, VCU Engineering's goal to demonstrate a student engagement continuum in an urban region draws upon the necessary ingredients, experience, and assets at critical educational stages that will tap into a currently unrealized wealth of diverse people, ideas and skill sets. VCU Engineering envisions this resulting in a robust pipeline of STEM professionals from *all* backgrounds, particularly traditionally underrepresented groups via thoughtful introduction and continuous engagement. Simply put, the ultimate objective of the student engagement continuum is to spark new initiatives across the educational ecosystem.

Generally speaking, the steady production of diverse STEM graduates is accomplished through a dependable pipeline of diverse student cohorts who are competent and prepared for STEM education at 2- and 4-year institutions. When done effectively, STEM pipeline development connects higher education, families, K-12 educators, community organizations, and industry partners as well as provides a spectrum of meaningful experiences towards skill development and career preparation. In addition to strengthening the connectivity among partners, a successful STEM pipeline brings with it a multiplier effect that overflows into other aspects of community building, so it has essentially a win-win outcome.

Suffice to say, many STEM pipeline efforts nationwide lack the essential ingredients to satisfy STEM job market projections or to produce populations of students that are truly prepared for the more cross-disciplinary shape STEM employment will take in the future. Effective STEM training must include communication skills, critical thinking, how to operate in multi-disciplinary teams, technical competency, real-world and global experiences, and even technology transfer in addition to the technical knowledge of the field. A student engagement continuum that interlaces life's experiences with community-supported opportunities would be broadly impactful in this regard and help accelerate the growth of STEM interest. As further evidenced by the "grand challenges" issued by the White House under President Obama and developed by the National Academies, many technology goals such as engineering better medicines, restoring and improving urban infrastructure, and securing cyberspace will only be successfully brought to fruition when collaborative teams embody diversity of thought (the power of diversity and inclusion) as well as a working understanding of how to leverage diverse experiences from nearly every aspect of human life. A close look at enrollment trends in STEM disciplines suggest that, in comparison with STEM job opportunities, too many domestic students lack either aptitude or interest in STEM prior to college and this does not keep pace with the growing job opportunities for STEM graduates. According to the Bureau of Labor and Statistics, STEM jobs will grow to nine (9) million by 2022. In terms of individual occupations, information security analysis has a projected growth of 37% until 2022 (the highest), whereas environmental science and protection has a projected growth rate of 19% (the lowest). However, both of these fields are very good prospects for STEM job seekers.

Clearly, STEM disciplines cover a broad range of topics and employment opportunities are numerous, yet many domestic students exit the STEM career pathway despite flexible career options. A student engagement continuum, if designed correctly, would translate the relevance

and importance of STEM education through constant engagement across all demographic groups and would include a wide range of partners in education, training, and career development.

Using Engagement for Pipeline Development

VCU Engineering has embarked on the early stages of an effort to construct a sustainable student engagement continuum at an urban institution. VCU Engineering observed that in order to enable sustainable change in the community, it must pay attention to strategies, practices, and the environment that unintentionally reinforce trends of inequity. It is also important to include those that are impacted the most in the discussions for change. This, in part, defined the broadening participation challenge and remains part of the thinking moving forward. Given that STEM-related activities are available in the Richmond region, this work addresses the gaps in coordination, development, and engagement, which self-limits the momentum and meaningful experiences for these students as well as the participation of students from underrepresented populations. After interviews and listening tours with Richmond region superintendents, center directors, university leadership, community leaders, teachers, and parents, three specific themes emerged:

1. Missed opportunities and frustrations are common.
2. There is a need to align student interest, university interests, and industry needs.
3. Excellent work is already occurring in active but siloed programs.

Following these conversations, VCU Engineering leveraged its expertise and community engagement tradition and focused on streaming together experiences that provide greater connectivity among programs; acknowledging the reality that every partner cannot do it all by themselves and clarifying the structure of a sustainable student engagement continuum. VCU Engineering also sought to bring about effective change by leveraging collective strengths to expose underrepresented populations to the pathways to entrepreneurship, innovation, and STEM careers.

The disjointed nature of current STEM pipeline development was also examined more closely, since goals and metrics only reveal part of the issue. This required an investigation and understanding of unknown influences, for example, whether the existing primary and secondary programming encourages STEM interest. Appropriately, establishing a data baseline was essential and involved collection, discussion and analysis of the following topics:

- Activities that were offered and are currently offered (including its history, structure, data on funding, attendance, partnerships, administrative structure);
- Programs that are achievable (i.e. methods for coordination and transitioning/overlapping between student experiences);
- Leadership tables (given no need to form a new group);
- The key features from the individual partners (strategic plan, demographic information, levels of engagement, classification of the STEM activities); and
- Challenges with current programming (communication, funding, participation, partnerships).

VCU Engineering approached pipeline development acknowledging that effecting change begins with design and communication. So, staffing was provided to support this endeavor. The School of Engineering hired a Director of Government and Community Outreach, a position that affords freedom to think strategically and lead the school effort, with direct reporting to the Dean of Engineering. In an effort to build upon the administrative momentum and structure, the dean and department chairs agreed to the formation of a new community engagement committee chaired by the director and comprised of faculty representatives from each department, which begins a cultural shift. In response to the more socially conscious graduate student population, the Director works closely with Engineering's Office of Graduate Studies to build a system and structure that leverages increasing interest in community engagement. VCU Engineering also created a graduate student service award that recognizes community impact and goes with recognition in research and teaching. Then, the VCU Leadership team sought out community groups in the Richmond region and introduced a strategy for building collective impact. The targeted members included academic units and research centers on VCU's campus, local 2- and 4- year institutions, local grade schools (public and private), regional learning centers, county, city and state government offices, non-profit organizations, libraries and museums, community leaders, and business in the region. A framework for engagement was designed, and activities were launched that enable the following: (1) the ability to form new relationships and strengthen existing ones, (2) a safe space to build trust among partners, (3) a clear, achievable plan that leverages the individual strengths of participating groups, (4) an effective communication approach founded on mutual respect among partners; and (5) a central focus that embraces diversity. Below is a snapshot of various activities launched, which represents less than 10% of community engagement activities within the School of Engineering (Note: "engagement" activities are defined by bi-directionality and long-term commitment).

Event Description	**Audience**	**Attendees**	**Engineering Volunteers**	**Description**	**Community Partners**
Early Engineers: Educate the Educators Workshop	County K-5 Teachers	85	Faculty, Staff, Grad. Students	Taught educators affordable STEM activities to take back to their classrooms.	County Schools
Mission Tomorrow	8th graders, all surrounding school districts	12k students, teachers	Faculty, Staff, Grad. And UG Students	Exhibit at career exploration event.	Chamber RVA
National Aeronautics and Space Administration (NASA) Day	3rd and 5th graders	150	Faculty, Staff, Grad. Students	Lead classes through activities as part of the space day which included the live uplink to the ISS.	Local Elementary, NASA
Barnes & Noble "MakerFest"	Families in the Willow Lawn Area	~50 K-12 children and their parents	Faculty, Staff, Grad. And UG Students	Displayed interactive activities on electrical circuits.	Barnes & Noble, Libbie Place
Castle Quest Science, Technology, Engineering, Arts and Math (STEAM) Night	Elementary students and their families	100 students and their families	Staff, NSBE student chapter	Activities on building and shooting catapults and building castle walls.	Local Elementary
Robotics Activities with Cub Scouts	Cub Scout Groups	10 cub scouts per group and their families	Faculty, Staff	Lead groups through robotic hand, drawing robot, and robot path activities.	Local Cub Scout Groups

STEAM Family Day	Students and families from STEAM resource schools	956 total attendees	Faculty, Staff, UG Students	Table with robotic hand demonstrations and activities.	County Schools, Science Museum of Virginia

Opportunities and Challenges

The process for building a culture that embraces and responds to the call for community engagement cannot be undervalued. While there are many community engagement opportunities that dovetails with externally-funded opportunities and student interest, a sustainable community engagement effort depends upon the will of the faculty to support and contribute to an effort that constantly evolves as the community evolves. Below are opportunities presented by an increase in community engagement.

- Since the beginning of this culture shift, there has been a significant increase in requests related to new public-private partnerships, teacher training, sponsored projects, student recruitment, and STEM competitions. Once the communities realized the talent present within the institution and vice versa, implementing necessary systems and structure to support community engagement was required, which was an administrative challenge. However, this gave way to new internal resources such as a job board of opportunities as well as community engagement kits. This resource will expand as partnerships develop.
- Informal conversations suggest that prospective faculty are also very interested in connecting with the community and supporting and nurturing local talent. As expected, the hiring of faculty with similar values served to strengthen the school's way of thinking.
- In terms of alumni involvement, there has been a surge of alumni returning to reconnect with the institution, which essentially broadens the community engagement footprint. Email communications, newsletters, and brochures that highlight community engagement activities have helped with brand enhancement and expanded the presence to more distant communities.
- Lastly, the opportunity for scholarly work is evident, and collaborations with education, arts, social work, and psychology, for example, bring new dimensions to community-focused efforts. Anecdotally speaking, the increase in new community engagement opportunities seems to derive from the quality of the public-private partnerships formed, scholarship developed from engagement efforts, and the quantity of participants impacted.

Similarly, the challenges of building a culture that supports community engagement cannot be underestimated. VCU engineering has found that many community groups could only depend on themselves, and while a partnership helps alleviate certain strains or resource gaps, they tend to continue to do much on their own. Even if working together is effective, there is a tendency to continue development of one-offs, which makes coordination more difficult. Below are preliminary findings of bottlenecks to enhanced community engagement.

- It is challenging to work with school systems that do not look at the school system as a whole. Obviously, many communities have partners that are not on equal playing fields, and the coordination and communication efforts can bring some partners closer faster and

more effectively than others. Our communication strategy and content must be designed to effectively relate to students, parents, and teachers.

- A major challenge relates to the time spent with partners such that information sharing is achieved. With so many administrative layers within each partnering organization, it is critical to develop quality relationships based on trust, transparency, and mutual respect.
- As interests from community partners grow, so does the demand on staff and faculty time. The biggest sources of strain relate to increasing difficulty responding to ad hoc requests.
- Ownership is required for sustained engagement. A leadership position within the school and dedicated to this line of work is important in terms of planning, sustainability, and scalability.
- Lastly, administrative turnover is problematic, especially when partnerships are new and still in its infancy stage. The development of leadership tables is helpful in this regard, but does not fill the relationship gaps.

Conclusion

The moral imperative to give back to the community can only go so far. The ability to leverage an engaged community for the purpose of sustaining a STEM pipeline presents opportunities and challenges, where opportunities strengthen community ties and challenges unintentionally undermine those efforts. If the goal is to create a sustainable STEM pipeline, then a continuum of experiences throughout the education ecosystem can be the common connection among all partners. The key features for developing quality relationships with the community involve trust, mutual respect, strong leadership, resource allocation, successful products of the pipeline and effective and constant communication. If all are aligned, then a highly-coordinated community can meet the workforce demands and build upon the foundation to uplift an entire region.

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