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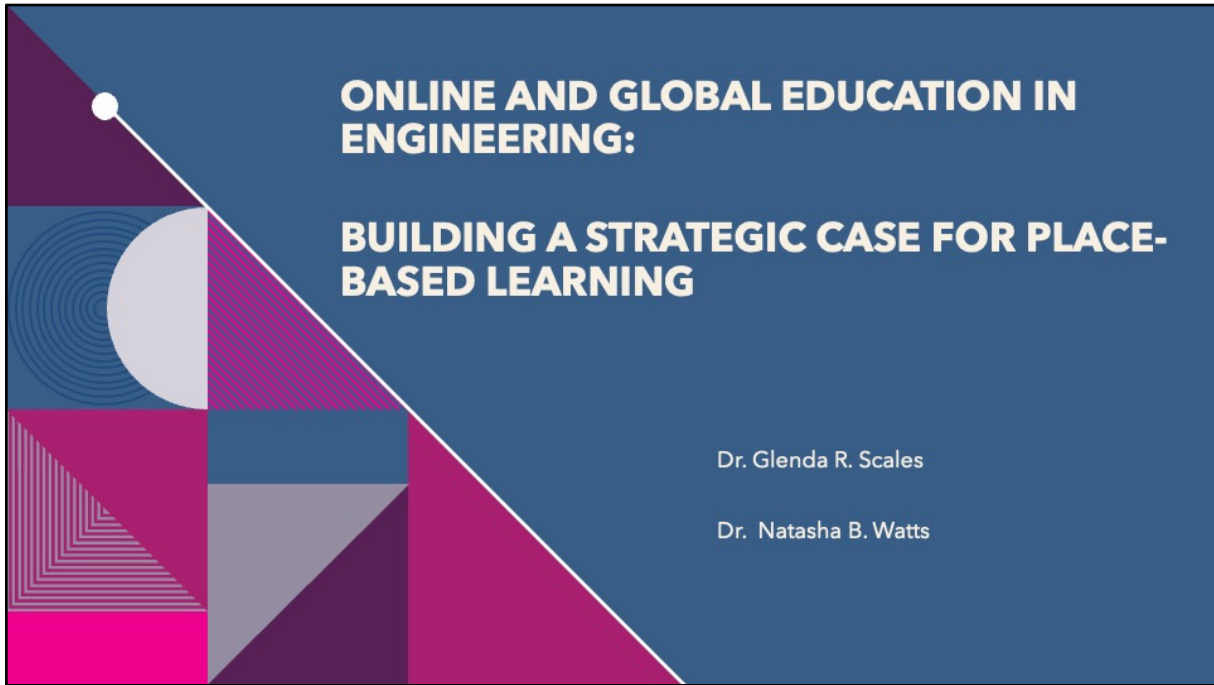
Online and Global Education in Engineering: Building a Strategic Case for Placed-based Learning

Dr. Natasha B. Watts, Virginia Polytechnic Institute and State University

As Director of Cardinal Education and the Associate Director of Online Learning in the College of Engineering at Virginia Tech, Natasha provides college-level leadership for the design, development, implementation, and evaluation of distance learning initiatives. Watts is the main point of contact for the Cardinal Education Program (formerly Commonwealth Graduate Engineering CGEP).

Before coming to Virginia Tech, Natasha worked as an Assistant Professor and Program Coordinator for Visual Communication and Computer Information at Hazard Community and Technical College. Watts began her career at Appalshop, a non-profit media arts center located in the coalfields of Eastern Kentucky, serving as a director, educator, filmmaker, and youth media trainer. For the last ten years, her work has focused on placed-based visual learning and distance learning methodologies to facilitate rural classroom equality. Watts is passionate about distance learning, accessibility, and Appalachia. She believes there is a classroom for everyone.

Natasha has a Bachelor's Degree in Broadcasting and Electronic Media, with a minor in Appalachian Studies from Eastern Kentucky University. A Master's of Science in Education with an emphasis on occupational training and development from Eastern Kentucky University, and a Doctorate in Educational Technology and Leadership from Morehead State University.

ONLINE AND GLOBAL EDUCATION IN ENGINEERING:

BUILDING A STRATEGIC CASE FOR PLACE-BASED LEARNING

Dr. Glenda R. Scales

Dr. Natasha B. Watts

Welcome guests. It is good to have everyone here today. I am Dr. Natasha Watts, and this is Dr. Glenda Scales. We both currently work at Virginia Tech in the College of Engineering. We are going to start by telling you a bit about ourselves.

Dr. Glenda R. Scales has spent over 20 years working in global education, online learning, and IT as an associate dean, director, and chief technology officer. Dr. Scales serves as the Associate Dean for Global Engagement, Chief Technology Officer, and the Director of Online Learning in the College of Engineering at Virginia Tech. She holds a Ph.D. in Curriculum and Instruction with a concentration in Instructional Technology from Virginia Tech, an M.S. in Applied Behavioral Science from Johns Hopkins, and a B.S. in Computer Science from Old Dominion University.

Prior to coming to the College of Engineering in 2000, Dr. Scales was the Director of Instructional and Research Computing at North Carolina A&T where she led a university team to launch their first virtual campus successfully. She began her career working as a computer analyst for the Department of Defense. Dr. Scales was appointed to the Southern Regional Education Board. This board works with 16 member states to improve public education, from prekindergarten through postsecondary education. She regularly presents to the American Society of Engineering Education and serves on Ph.D. graduate committees.

As a former professor, director, and program coordinator, Dr. Natasha B. Watts has worked in online learning, education, and media development for 14 years. Natasha currently serves as Director of Cardinal Education, formerly the Commonwealth Graduate Engineering Program, and the Associate Director of Online Learning in the College of Engineering at Virginia Tech. Dr. Watts provides college-level leadership for the design, development, implementation, and evaluation of distance learning initiatives. Watts is the main point of contact for distance learning-related issues within the College of Engineering.

Before coming to Virginia Tech, Natasha worked as an Assistant Professor for Visual Communication and Computer Information at Hazard Community and Technical College. Dr. Watts began her career at Appalshop, a nonprofit media arts center located in the coalfields of Eastern Kentucky, serving as a director, educator, filmmaker, and youth media trainer. Natasha has a Bachelor's in Broadcasting and Electronic Media, with a minor in Appalachian Studies. She earned a Master of Science in Education from Eastern Kentucky University, and a Doctoral degree in Educational Technology and Leadership from Morehead State University.

During this session, we want everyone to think more explicitly about how you are using your work to bridge gaps in engineering. This presentation should create awareness in using virtual spaces to help connect with underrepresented minorities in the US or international students worldwide. The work of today's engineers is all about global business. We want you to think about how you are using virtual environments for student engagement.

During this session, we will give you three different ways to assess value to your work and think more strategically about creating an experience for students outside of physical spaces. Some students cannot come to your activity for barriers that we are not even aware of. Many underrepresented-domestic and international students have barriers to access. We want to increase these numbers and break down those barriers with innovative approaches.

In 2021 report by Dr. Dominique Harrison at the Joint Center for Political and Economic Studies on Internet access in the Black rural South (Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, and Virginia) found that 38% of Black residents in 152 county area within those states did not have access to the Internet in their homes[1]. Many students living in these areas also face socio-economic challenges, with 49% of children in the Black rural South living in poverty [1]. Students in the states noted in Dr. Harrison's report often work and lack the extra funding needed for travel. The social dynamic is far out of their comfort zone to attend events that would

expose them to opportunities. Given the pressing need for the Internet in the last few years due to the pandemic, access to virtual environments is needed now more than ever. Students can get to a virtual environment much quicker than a physical one and for less money. We must start creating spaces that allow students to learn where they are. The outcome of this session is to create awareness for identifying and creating opportunities in online environments that help broaden the experiences of students from marginalized backgrounds both domestically and internationally.

At the end of the session, we will get into small groups. In these groups, you will identify any in person work you are doing that could have a complimentary online/virtual component for domestic or global students. How can you use online learning to increase diverse voices in engineering? During the pandemic, we all used different tools to connect. While daunting at times, those tools allowed us to connect in ways we had never done before. We want to do more than connect to our students. We want to build relationships and join them where they are. Using this time to explore high-quality engagement for students is critical.
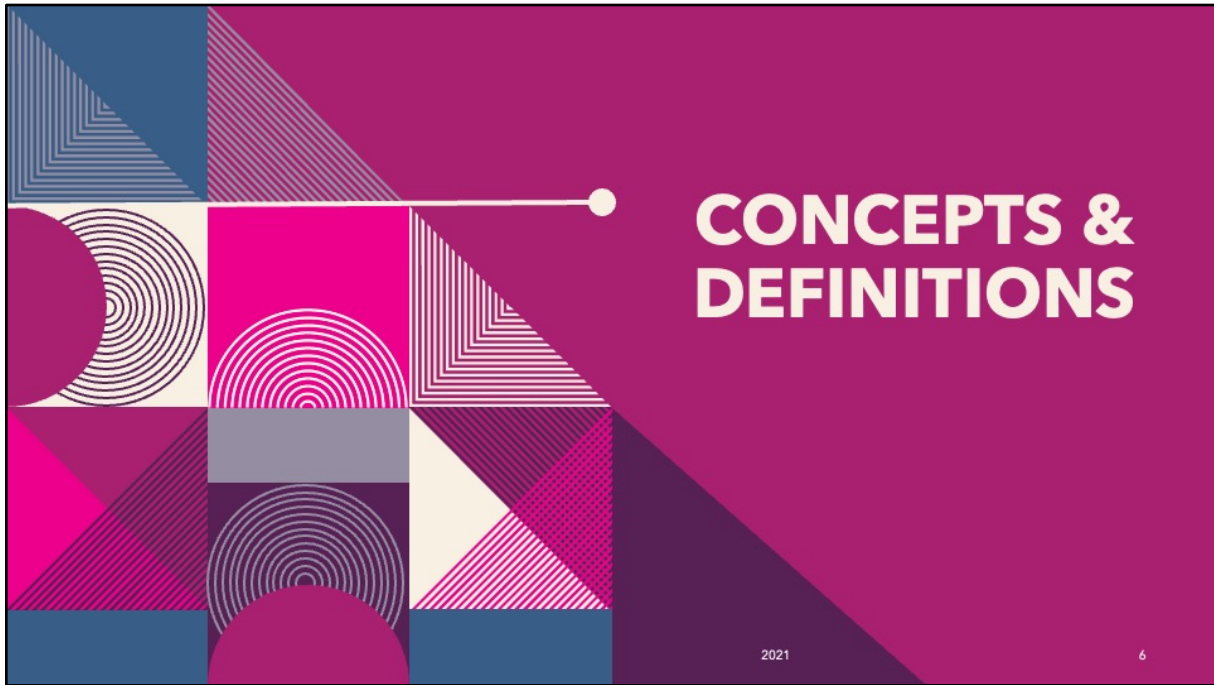
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Introduction of concepts and definitions

ONLINE

HISTORY

Online learning started as correspondence education in the early 1800s [2]. Modern-day distance education started in the 90s within the U.S.

DEFINITION

Online learning is the use of the Internet and learning management systems to facilitate at least 80% of learning content online [4]

TARGET AUDIENCE

37% of online students are the first in their family to attend college, and 70% of online learners are female [5]

ACCESS

In the fall of 2018, more than 6.9 million students, or 35.3% percent of students in the nation, were enrolled in distance education courses at degree-granting postsecondary institutions [6]

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Online learning has long been linked to innovation in higher education [3]. It dates back to the early 1800s when we used letters to correspond with one another in what is now known as snail mail. Online learning has many definitions depending on state of innovation of your school or work setting. However, broadly speaking, it is the usage of the Internet to transmit learning materials across borders [2].

Understanding how innovation like online learning can be applied in classrooms is deeply rooted in a cultural narrative. What do we mean by that? For-profit institutions headline online learning programs with large enrollments. However, online learning is over 40-years old and started in much more community-centered spaces like community colleges. If we look at online learning enrollments provided by IPEDS and the Post-Secondary National Policy Institute in 2018 and 2019, 37% of online learners were the first in their family to attend college, and 70% of online learners identify as women. Understanding these current and past structures will help us understand the paradox that now exists in online learning— using online as an innovative way to grow our classroom and not as a barrier could help us build stronger learning communities for underserved students.

We must also contextualize our understanding of online learning by outlining current

barriers to Internet access that exist. We cannot move forward without recognizing that there is much work to be done so that everyone has equal access.

Programs across the U.S. are looking for ways to grow student's enrollment from diverse backgrounds. At the same time, they are working to increase the number of international, experiential learning opportunities for students. While these two topics are in constant flux and contention with one another, online learning could provide a valuable exploratory option for those seeking to improve their numbers both financially and domestically to achieve access to quality education for all students. Global learning was born to help students become more globally aware [7]. It also grew out of a need to help strategically solve complex problems that affect humanity. The lens of global learning is often directly linked to exchanges and travel. Those two concepts will always be valuable. However, project collaboration, community building, and connection online could help bridge experiences and student development.

Place-based education is defined as the process of using the local community and the environmental ethos that resides in it as a starting point to teach concepts like math, language arts, science, and social studies. Providing hands-on, real-world learning experiences allowing students to develop stronger ties to their community, creating a heightened sense of service and contribution[8] . Building intentional learning environments will allow students to learn from where they are. This comfort zone could be vital to bridging diverse students into fields like engineering that White males primarily dominate. For many marginalized students, it is imperative to their success that they are allowed to be the voice of their own stories [9]. Allowing students to build a sense of community, learn from each other and explore more experiential learning environments could be a critical factor in creating long-term success rates. These marginalized communities and students need more initial pathways to community and learning [10].

Higher education business models often lead their-hand to performance-based metrics. When we look at the growth in online learning and the staggering number of people worldwide who are enrolling, we can see its potential to help bridge the gaps for students from diverse and marginalized backgrounds. The National Center for Education Statistics Integrated Postsecondary Education Data System (IPEDS) data shows that in the fall of 2018, more than 6.9 million students (about twice the population of Oklahoma), or 35.3 % of students in the nation, were enrolled in distance education courses at degree-granting postsecondary institutions [6]. Additionally, as mentioned earlier, 37% of online students are the first in their families to attend college, and 70% of online learners are female [5]. When we think about this data matched with the disproportionate number of first-generation female students who enroll in engineering, we can see that online learning could potentially be a place to help facilitate more community engagement among those students. These numbers help us build a strong case for having more initial programs and courses available for students in engineering.
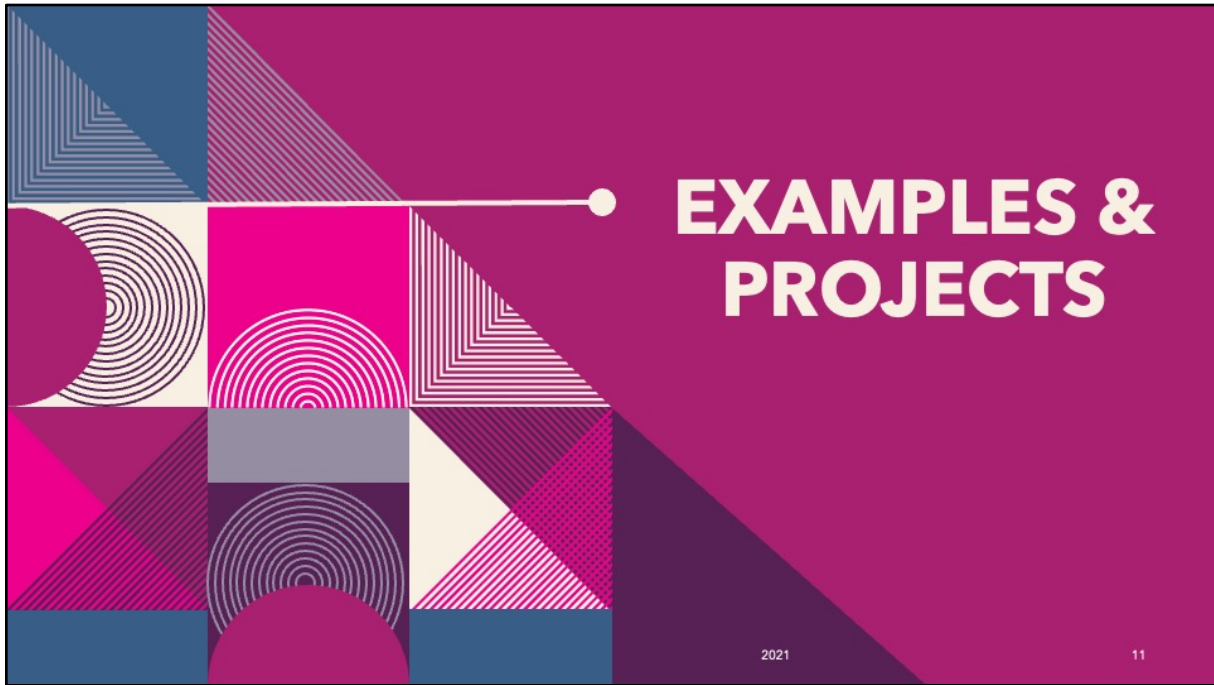
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Introduction of concepts and definitions

Quantum Information Science and Engineering (QISE) is expected to revolutionize society in the coming decades. Significant investments are being made in the U.S. and abroad to gain a technological edge. However, we do not currently have a well-trained QISE workforce, which presents a challenge due to the highly interdisciplinary basic science and engineering nature of QISE. There is growing progress on the software training side (i.e. IBM QISKIT), but hardware and experiential learning have lagged despite being considered critical by industry. Virginia Tech has recently developed a unique QISE hardware capacity to meet this need. With the development of hardware and the lab at Virginia Tech comes the opportunity to help diversify the workforce in this emerging engineering field.

Historically Black Colleges and Universities (HBCUs) could play a critical role in growing the QISE workforce. Currently, no HBCUs have specialized hardware laboratory capabilities for workforce development and the associated student research. Virginia Tech College of Engineering is currently working with the QISE hardware laboratory to facilitate a QISE partnership with Prairie View A&M University. The virtual laboratory will be beta tested by both Virginia Tech and Prairie View A&M students during Spring 2022. The entire course (in-person and virtual) will be offered in Fall 2022. During Spring and Fall 2023, using the Inclusive Engineering Consortium IEC (iec.org), partnerships to utilize the lab course will be offered to the other 18 IEC HBCUs to develop further HBCU partnerships in QISE research and education.

Engineering Online at Virginia Tech, guided by Professor Wayne Scales, is developing the virtual laboratory and course. Virginia Tech Engineering Online has supported award-winning online lab instructional design in the past. Virginia Tech is currently designing one virtual laboratory (on quantum cryptography) for testing in Spring of 2022. The other eight laboratories will be completed by June 2022 to begin beta testing with Virginia Tech and Prairie View A&M University students in Spring 2022. Further refinements would be made over Fall 2022 and Spring 2023 to make the role out to other potential HBCU partners.

During the summer of 2021, Virginia Tech Engineering Online (VTEO) helped facilitate online courses for the Tech Girls program. The program traditionally brought young women to campus at Virginia Tech. However, due to travel restrictions and the ongoing pandemic, the project leaders shifted to a virtual environment. Faculty at Virginia Tech were chosen to teach unique courses in several engineering fields. The VTEO team helped migrate the materials into our Learning Management Systems and monitor student engagement to ensure access and community-building learning opportunities for everyone. Young women from Jordan, Lebanon, Palestinian Territories, Egypt, Tunisia, Morocco, Algeria, Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan, and the United States participated. This allowed a program that would otherwise have been shut down to continue during these critical times.

Working with our Global Education office, Dr. Kevin Kochersberger has been active with international student projects for several years through the mechanical engineering senior design program. Working directly in Senegal, Peru, and Malawi, and indirectly in Rwanda, Dr. Kochersberger has initiated 21 international capstone projects and advised 15 of these in a six-year period, with work focused on agriculture, healthcare, water, and sanitation. These projects have given technicians in Malawi a new latrine pit desludging technology (replicated in Niger), NGOs in Peru a portable exam table for cancer screening, and farmers in Senegal a simple grass chopping system for making silage for livestock.

Over a six-year period, more than 130 Virginia Tech students have been exposed to these international projects where design work is no longer constrained to product development; cultural and economic factors are equally important for product success. In the early phases of the design work, the students communicate with international sponsors via phone and videoconference. At the product realization phase, completed projects and designs are sent to the sponsors, and in five cases, Dr. Kochersberger took the design teams abroad to present their design work to the sponsors. These teams ranged from one to five students traveling to Senegal, Malawi, and Peru for one week each, collaborating with health care workers, water and sanitation experts, and farmers. Students worked with technicians, other students, and government workers from a new culture. Explaining their designs to a new audience and fixing problems with limited time and tools is an intense learning experience
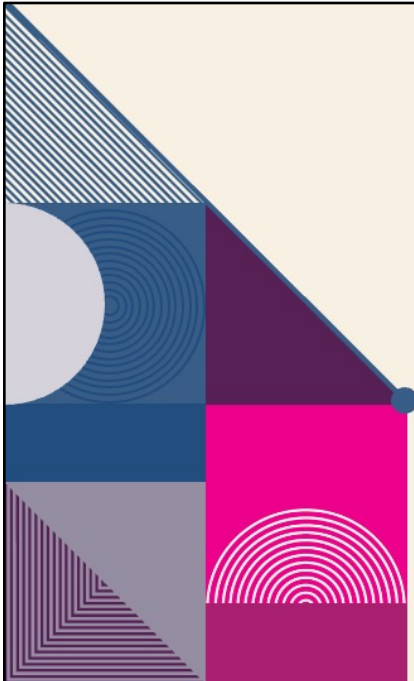
but truly rewarding and life-changing.

Online allows us to transcend borders and meet students where they are. It builds safe spaces for students to test higher education and various types of learning opportunities. Online learning allows us to build intentional communities. It also provides an opportunity to reach more students.

Global education diversifies engineering work. It allows students the opportunity to grow through personal connection and exploration, creating more well-rounded engineers. It could also present many opportunities to explore more partnerships.

A place-based curriculum pulls in materials that directly relate to students. It helps connect students with the discipline by utilizing community drive design.

SMALL GROUPS

Guiding Questions:

1.) Identify an in-person event that could have a complimentary online/virtual component.

2.) Identify current divides that exist when doing in-person events that could potentially be addressed with online/virtual (keep in mind the accessibility for those living in areas with poor internet access).

3.) Identify ways that online learning could be used to increase diverse voices in engineering

4.) Explore what high-quality online engagement means.

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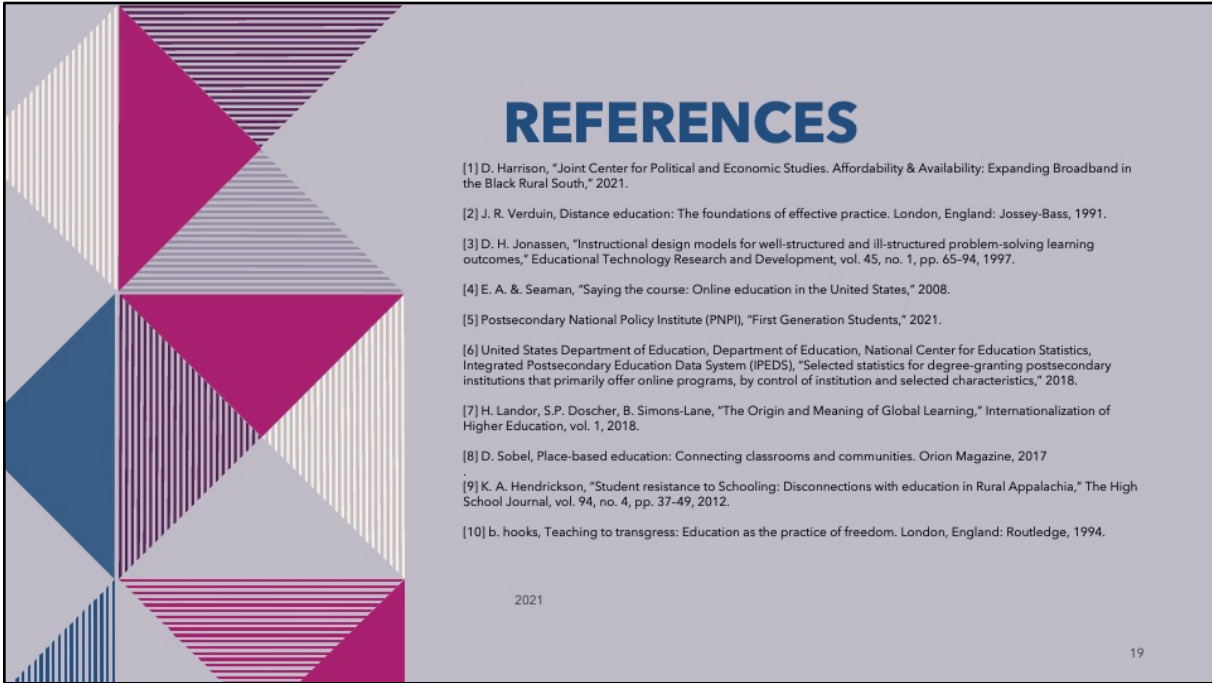
We will break into groups of no more than 7 for 15-min. You will discuss your current work; each team will choose one example to present to the larger group. The example will display how you could add a virtual component to help increase students' access, diversity, or international experience.

1.) Identify an in-person event that could have a complimentary online/virtual component.

2.) Identify current divides that exist when doing in-person events that could potentially be addressed with online/virtual (keep in mind the accessibility for those living in areas with poor internet access).

3.) Identify ways that online learning could be used to increase diverse voices in engineering

4.) Explore what high-quality online engagement means.

We will have Q&A at the end.

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References