

**Exploring Remote Work-Related Experiential Activities in Engineering and Computer
Science: Understanding Participation Rates and Stakeholder Perspectives**

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Abstract

The Covid-19 pandemic has fundamentally changed the way Americans think about work and where that work must take place. At the start of the Covid-19 pandemic, offices shut down if they could, and many workers switched to a “new normal” of working from home. As the Covid-19 pandemic continues, some companies are switching to remote work indefinitely, potentially for good. This trend toward remote work (at least in some fields) is likely to persist even as the Covid-19 pandemic fades and public health precautions wane. In this environment, there is a need to understand better which students participate in remote work-related experiential activities (WREAs) and the perspectives of relevant stakeholders on the value of these experiences. In this mixed-methods study, we look at who participates within the fields of engineering and computer science in remote WREAs along with relevant stakeholders’ perspectives on the value of these experiences. Using data from multiple sources, we construct a broad sense of how remote WREAs fit into the larger conversation on WREAs and provide suggestions for research and practice.

Exploring Remote Work-Related Experiential Activities in Engineering and Computer Science: Understanding Participation Rates and Stakeholder Perspectives

At the start of the Covid-19 pandemic in early 2020, baccalaureate students who were interested in work-related experiential activities (WREAs), such as internships or co-ops, found their prospects frequently limited to remote opportunities or canceled altogether (Braga, 2020; Lumpkin, 2020). As the Covid-19 pandemic wanes, some companies are switching to remote work indefinitely (Vasel, 2022). This trend toward remote work and WREAs is likely to persist as the number of remote experiences grows (Konkel, 2021). However, it prompts additional studies to understand the impact of these changes in work-related experiences. Guided by literature on the benefits of and barriers to participating in WREAs and the potential of remote WREAs to expand access to these opportunities, this mixed-methods study seeks to describe student participation in remote WREAs and examine the perceived value of these experiential activities from multiple stakeholder perspectives.

Benefits of WREAs

The Association of American Colleges and Universities considers WREAs a high-impact educational practice (Kuh, 2008). Increasingly, universities mandate WREAs as a graduation requirement (Hora, Parrott, et al., 2020). Research suggests that WREAs (often focusing on internships) are associated with positive gains for students in academic achievement (Binder et al., 2015; Knouse et al., 1999; Kuh, 2008; Parker et al., 2016), employability (Callanan & Benzing, 2004; Frenette et al., 2015; Gault et al., 2010; Knouse et al., 1999; Nunley et al., 2016), and career learning (Dirienzo, 2016; Frenette, 2013; McGee & Spiro, 2000). Importantly, within this literature, differences can exist between different fields on the outcomes associated with

participation based on numerous factors (Hora et al., 2017), though some generally positive outcomes still hold across fields (Binder et al., 2015; Parker et al., 2016).

While there is substantial literature supporting the value of students' participation in WREAs that are completed face-to-face in the employer setting, less is known about how students and other stakeholders perceive the value of remote¹ WREAs. Thus, this paper addresses the following questions:

- 1) Does participation in remote WREAs differ by students' demographic characteristics?
- 2) Do select items of importance influence students' choice of WREA modality?
- 3) How do stakeholders (i.e., students, employers, and career center administrators) perceive the value of remote WREAs?

As trends continue toward an increasing number of remote opportunities, it is increasingly important to better understand the challenges and benefits associated with remote WREAs to provide broad access to high-quality, meaningful work-related opportunities. A deeper understanding of remote opportunities can help campus career officials and employers to determine if revisions are needed in forms or frequency of communication between the student and work supervisor, relevant activities that can be assigned, and how to manage interactions with mentors that lead to a successful work-related experience.

Literature Review

Barriers to Participation in WREAs

While there is a robust literature on the benefits gained from WREAs, some scholars also note the barriers to WREA participation (Bathmaker et al., 2013; Dirienzo, 2016; Frenette et al., 2015; Hora et al., 2017, 2019; Hora, Chen, et al., 2020). For example, Hora et al. (2019) found

¹ For the sake of clarity, remote here refers to what authors have called online, virtual, remote, or computer-mediated activities.

that 64% of internship non-participants wanted to participate but were unable due to financial, sociocultural, and/or institutional barriers. These barriers identified by Hora et al. (2019) can include the need to work for pay (if the WREA is unpaid), transportation issues, school workloads, or a general lack of access to opportunities. Because WREA participation has positive outcomes for students, inequities in access may have severe repercussions for students unable to participate, especially those from disadvantaged groups.

The Potential and Limitations of Remote WREAs

While researchers have suggested that remote opportunities may expand access to WREAs (Jeske & Axtell, 2014; Kraft et al., 2019), Hora, Vivona, et al. (2020) warned against considering all remote experiences equal due to different designs and structures. Recent work suggests that remote WREAs offer some benefits, create new challenges, and/or may fail to meet student and employer expectations (Bayerlein & Jeske, 2018; Bell et al., 2021; Cabrera Rasmussen & Van Vechten, 2021; Hora et al., 2021; Judene Pretti et al., 2020; Morrill Bijeau & Peters, 2021).

Remote WREAs offer the opportunity to develop work skills similar to in-person WREAs, though not always the same skills or to the same level (Bayerlein & Jeske, 2018; Bell et al., 2021; Cabrera Rasmussen & Van Vechten, 2021; Morrill Bijeau & Peters, 2021). However, despite possible limitations, students have reported growth in independence, discipline, communication skills, organization, and critical thinking in the remote environment (Judene Pretti et al., 2020; Morrill Bijeau & Peters, 2021). Strong mentorship may further influence some skills' development (Jeske & Linehan, 2020). Students report taking remote opportunities, among other reasons, to develop skills for future remote work, though these desires are not always realized (Hora et al., 2021). Moreover, remote WREAs can be more affordable and offer

greater flexibility than in-person WREAs (Bayerlein & Jeske, 2018; Bell et al., 2021; Hora et al., 2021; Judene Pretti et al., 2020).

While remote WREAs offer some benefits, they are limited in important ways. Some researchers suggest that remote WREAs cannot fully replicate the in-person experience (Bayerlein & Jeske, 2018; Bell et al., 2021; Cabrera Rasmussen & Van Vechten, 2021). Further, students report many challenges while working remotely, including experiencing fewer social interactions and isolation, slower communication, difficulty staying motivated, internet access and general technology issues, privacy concerns, and difficulty creating physical and mental barriers for themselves to work (Bell et al., 2021; Cabrera Rasmussen & Van Vechten, 2021; Hora et al., 2021). Networking and informal interactions proved challenging but not impossible when remote, as employees and employers looked for opportunities to create space for those engagements (Cabrera Rasmussen & Van Vechten, 2021; Hora et al., 2021). Being remote often means not being visible to show desirable qualities and can create anxiety for students about employer evaluations (Judene Pretti et al., 2020).

Further, remote WREAs can create barriers to access (Cabrera Rasmussen & Van Vechten, 2021; Hora et al., 2021). In addition, remote experiences may have challenges similar to experiences that are in-person, including course load, lack of opportunity, and low or no pay (Hora et al., 2021). Hora et al. (2021) found that participants in remote WREAs were generally from more privileged groups because of the similar issues that prevent participation in in-person WREAs. Although limited in frequency to date, remote WREAs, thus far, have generally failed to deliver the same experience as in-person and have not opened access as predicted. Further, stakeholders have expressed somewhat negative views on remote experiences, with students reporting “lower satisfaction, developmental value, 21st century skills, professional network

development, and high-skill tasks than in-person interns” (Hora et al., 2021, p. 58). Additionally, employers have similarly suggested that the remote environment makes it more difficult for some students to gain relevant skills (Morrill Bijeau & Peters, 2021). Although remote WREAs are relatively new, the above research identifies a number of challenges that exist and the need for continued study to ensure that it can prepare students for successful career employment.

Methods

As part of a larger mixed-methods project on students’ transition from education to work, this study sought to gather information and perceptions from various relevant stakeholders on students’ access to and benefits received from WREAs. Survey and interview data were collected at six universities located in different geographic regions across one southeastern state. Five of the six universities are public, and all have long-standing commitments to STEM education. In the spring of 2021, a *Career and Employment Survey* was developed, pilot tested, and then administered to upper-level students majoring in engineering and computer science at five of the six universities (policies at one institution did not allow us to survey students at that location). The survey sought to determine which students engaged in WREAs, how many WREAs they completed, the modality of each activity, and whether they found the WREAs beneficial. Following completion of the survey, we interviewed a convenience sample of students at each institution to explore further students’ perceptions about their WREAs. In addition, we interviewed a senior-level administrator working with career services at each institution and conducted focus groups with a total of 21 employers who recruit or hire engineering or computer science students for WREAs or full-time work from our selected institutions.

Survey Data

The *Career and Employment Survey* was distributed electronically via Qualtrics (Qualtrics.com) in spring 2021 to all juniors and seniors majoring in engineering and computer science at five institutions. The survey asked respondents to indicate how many WREAs they had participated in, the length and modality of each experience, items of importance in their choice of WREA, and if their WREA experiences had helped them gain important work-related skills. Specific to the analysis herein are responses to the question: *When considering your WREA activities, how important were the following items: 1. time it takes to get to the WREA; 2. ability to work from home; 3. rural setting; 4. urban setting; 5. access to public transportation; 6. access to parks & recreation; 7. access to shopping; and 8. being close to friends & family.*

Following survey invitation and three reminder emails, we received 1,447 usable responses, yielding a response rate of 13.1%. Descriptive statistics are shown in Table 1. As shown, respondents reasonably represented students by gender, race/ethnicity, and financial aid status. Although only 11% said that a work-related experience was required for their baccalaureate program, 45% completed one or more WREAs.

[Insert Table 1 about here]

Survey Analytic Plan

Descriptive statistics were completed as a first step to gaining a general understanding of the data. Responses were weighted by institution and gender. However, comparisons of weighted and unweighted results showed no significant differences, thus, unweighted responses are reported herein. Following the descriptive inquiry, additional analyses examined factors related to students' participation in WREAs. Survey questions related to the eight items of importance in the choice of WREA did not allow disaggregation of responses for each WREA activity separately, thus, we ran a multinomial logistic regression with the dependent variable having

three outcomes: participation in one or more remote WREAs; in-person WREAs; or activities that included both in-person and remote, we call ‘hybrid.’

The multinomial regression is an extension of the binary logistic regression used to predict probabilities for an analysis with more than two discrete outcomes. Like binary regression, multinomial regression typically uses maximum likelihood estimation to evaluate the probability of categorical membership. In our analysis with three nominal outcomes for WREA modality- remote, in-person, or hybrid, the multinomial model determines the log odds (B) or odds ratio (exponentiated B) modeled as a linear combination of the predictor variables.

Guided by previous literature on the benefits of and potential barriers to WREAs, the contributing variables included gender, race, first-generation status, financial aid status, and responses to eight items that influenced students’ choice in considering a WREA. Items are detailed in results in the tables below.

Qualitative Data Sources and Analytic Plan

Our qualitative findings for this analysis include individual interviews with career center administrators (CCAs) at all six institutions, focus groups with employers, and individual interviews with students who discussed their WREA experiences. We developed and piloted semi-structured interview protocols before conducting interviews and focus groups. Interviews were conducted by the project’s lead researchers or members of the research team. CCA participants were recruited based on their institutional roles. Interviews with each CCA lasted between 30-60 minutes and were completed via Zoom.

In addition to CCA interviews, we conducted five 60-minute focus groups via Zoom to gather employer perspectives, resulting in 21 employer or recruiter participants. Organizations of the participants included state government, small companies, and major food producers who seek

prospective employees with science and engineering backgrounds. Often located in the study's state, participant employers spanned the country representing highly urban to more rural areas, all of which provided breadth to our understanding of their perceptions of remote experiences and WREA participation more generally. Employers were recruited from contact information received from career center directors as well as from other campus colleagues who worked with external employer organizations. While we drew on the larger group of employers, not all had direct experience with remote WREAs. Table 2 shows the complete list of employer participants, their hiring area, industry, and whether they had experience with remote WREAs or work. We included those whose work was hybrid as having experience with remote for the qualitative analysis.

[Insert Table 2 about here]

To further support our understanding of the value of WREAs, we conducted in-depth interviews with students attending the six institutions. Herein, we report on 23 of 48 completed interviews in which students discussed remote WREAs, varying in detail. Each interview lasted between 30 and 75 minutes. Student recruitment required multiple approaches, including recruitment flyers sent via email, follow-up with survey respondents who expressed interest, and snowball sampling. We recorded and transcribed all interviews and focus groups and then cleaned the data for errors and removed identifying information. Following Miles et al. (2019), we iteratively developed a larger coding scheme for employers, CCAs, and students. Researchers began by inductively coding transcripts and then refined the code list based on our understanding of what participants thought about remote experiences. Researchers then met to reconcile any coding discrepancies and reach inter-coder agreement (Miles et al., 2019).

Limitations

While this study offers new and valuable insights into remote WREA experiences, we acknowledge some limitations. Despite a consistent method used for distribution, survey response rates were not equal across all institutions. Initial comparisons of weighted and unweighted responses yielded no substantial differences, thus unweighted responses were used for subsequent analyses. We also note that missing data limited some analyses, but surveys with less than 10% completed were excluded from the analysis. Mindful of these issues - concentration of responses from two institutions, instances of missing data, and the overall response rate of 13.1% – we do not attempt to make any generalizations of the survey results presented in this paper.

With our qualitative data, our findings must be understood within the context of the Covid-19 pandemic. As mentioned by employer participants, many WREAs in which many of our students participated were switched to remote in an emergency rather than carefully designed and at times drifted into hybrid rather than fully remote. It is also important to note that the employers we interviewed who were hiring for remote WREAs were largely seeking computer science interns: however, this imbalance may be related to our limited small sample.

Findings

Survey Results

Table 3 includes information for students who completed the spring 2021 *Career and Employment Survey*. As shown, a majority of respondents said they completed at least one WREA, with approximately 59% having completed more than one. On average, respondents spent about 35 hours per week on their WREA. When asked about the modality of their WREAs, 27% said their WREA engagement was remote, 55% said they engaged in-person, and 18% of WREA activities were done in hybrid experience.

[Insert Table 3 about here]

Multinomial logit model results displayed in Table 4 examine the contribution of respondents' demographic characteristics and factors that were important when considering the decision to take a remote, in-person, or hybrid WREA. Shown in Table 4, some demographic characteristics and items of importance were significant when we compared the three WREA modalities. Please note that the reference group is remote WREAs. All else constant, and compared to those who participated in remote WREAs, older and first-generation respondents were more likely to favor in-person WREAs (odds ratio via $\exp B=1.333$, $p<.001$ for age; $\exp B=2.674$, $p=.008$ for first-gen status). However, compared to White peers, Asian students were significantly more likely to favor remote WREAs ($\exp B =0.551$, $p <.008$).

[Insert Table 4 about here]

In addition to respondent demographics, the importance of access also played a role to some degree when considering the WREA's modality. Compared to students who completed remote WREAs, students who took on in-person WREAs were 39% more likely to emphasize the time it takes to get from their home to the WREA ($\exp B=1.393$, $p <.001$). Compared to remote WREAs, respondents were 29% more likely to emphasize the importance of a WREA's rural setting ($\exp B=1.299$, $p =.046$). Alternatively, students who heavily weighted the ability to work from home ($\exp B=0.647$, $p <.001$) and the urban location of a WREA ($\exp B=0.791$, $p =.015$) have a significantly higher likelihood of choosing a remote WREA, all else constant. Other items listed (public transportation, parks/recreation, shopping, and family/friends) did not achieve significance in the importance of choice in WREA modality.

Shown in the bottom half of Table 4, these trends were similar, albeit weaker when comparing remote to hybrid WREAs. Differences between Asian and White students and first-

vs. non-first-generation students are no longer statistically significant, though their coefficients maintain the same directional relationship described above. However, older students continue to show a significantly higher likelihood for participation in hybrid WREAs compared to fully remote opportunities. The time it takes to get to the WREA and work from home remained a significant issue of access, but geographic location (as indicated through the questions on rural and urban setting) were no longer significant.

Qualitative Findings

Qualitative analysis of individual interviews and focus groups offers the opportunity to see nuance and greater insight into a phenomenon that may not be readily available in quantitative analysis of survey findings. In addition to some significant survey results, our qualitative data analysis revealed additional findings that help illuminate the value that stakeholders find in remote experience relative to in-person opportunities.

Career Center Administrator (CCA) Perspectives

When asked about their perception of remote WREAs, CCA participants saw staying power in remote experiences because of the perceived benefits offered to students and employers. For example, Bonny expressed that during the Covid-19 pandemic, many employers shifted to provide remote opportunities. She admitted that when companies learned how to move online successfully, she believed that the “value is still there” and that remote experiences offer many benefits, such as flexibility in the offerings and the ability for employers to recruit from beyond their geographic location. Holly echoed this sentiment about the expanded reach of employers: “So, I think with virtual [remote] internships, we’re seeing an increase of recruitment from companies out of state. So, I think students are taking advantage of that differently now.” Other CCAs discussed the ability for employers to hire from out of state, but it was not the only

benefit they identified. Robert suggested that “from the student perspective, they can get more work done if they don’t have to drive 20 minutes to get to their site.” He also saw benefits for employers who needed “one less space to allocate to an intern.” Jacob told us that some companies planned to have remote and in-person opportunities. In his understanding, with many jobs, the kinds of things one might do in an in-person WREA (e.g., hold meetings, collaborate on projects, meet with executives) could all be done remotely. According to Robert and Jacob, through remote WREAs, students get back time, and employers need less space, perhaps while replicating in-person tasks.

According to CCAs, remote opportunities benefit students and employers, but they also noted that some challenges exist. Elyse told us that some internship experiences are difficult to replicate in a remote space. Her example involved tourism, but her larger point remains that some industries and jobs are likely more conducive to remote environments than others. As we saw with our employers, those in engineering frequently only offered their positions in person. Mark V., a CCA, said: “So, generally, what our employers have been talking about as a virtual [remote] internship is, ‘I hired you, and we were going to be in-person, but now we can’t, so we’re going to switch that to a virtual internship.’” However, Mark V. stressed the need for moving to remote opportunities with intentionality. He provided an example of one organization that intentionally designed remote that provided a similar experience of in-person positions within their company.

For our CCA participants, the perceived benefits of remote WREAs of flexibility, increased geographic reach, and time and space savings led them to believe that remote experiences would remain. However, there were concerns about how intentionally designed the remote experiences were. Our CCA participants help illuminate the broader perspective of

students and employers due to their unique positioning and show larger concerns that may extend outside of the narrower perspectives of our employer participants and students within engineering and computer science.

Employer Perspectives²

Benefits of Remote WREAs. Related to remote experiences, employers identified far fewer benefits than challenges. The most frequent benefit identified echoed what our CCAs said: increased geographic scope of hiring. With remote positions, employers can attract the best talent to their organization regardless of their location. Bill explained that his organization's headquarters is located in a less desirable location in the Midwest and that they struggled to get students to work there. However, since going remote, they have seen talent attracted from all over the country. Kendall shared a similar sentiment of expanded reach if in a different direction. He explained that going remote, "It actually opened it up, we were able to open that pool of untapped [talent in the West]. In fact, some of those universities that we've never recruited from before." With remote opportunities, these employers saw that they could now recruit from places they had not before and attract students to jobs, not locations.

Another benefit of remote WREAs was the organizational growth prompted by the switch to remote work. Danna explained that while they typically operate only in person, they used a student as a "test dummy" on remote WREAs. According to Danna, this organizational shift benefited them because she could "test them out for a whole year rather than just 12 weeks," as with their typical WREA summer internship opportunities. With the addition of remote internships, students can continue working with their organization even though they may be

² Less than half (nine of 21) of the employers with whom we spoke did not have much experience with remote WREAs due either to the nature of their work (e.g., construction engineering requires field work) or because their company did not switch to remote during the Covid-19 pandemic. It is noteworthy that the employers who had direct experience with remote WREAs almost exclusively hired computer science students.

located outside of a reasonable driving distance. Pete provided the most extensive discussion of their changes to support students. His organization's leadership highly valued the company's internship experience and transitioned it to remote during the Covid-19 pandemic. Through their shift to remote, they developed more robust mentorship and cohort programs. The cohort program had recruiters meet with 10 students weekly, so "everybody was coming together and getting to share what they've been doing and what they've been learning throughout the week. So that was another piece that was successful." These organizational shifts helped to strengthen the program from Pete's perspective. As employers help show, remote opportunities can open the organization to people outside the immediate geographic area and push the organization to grow in ways that benefit students and the employer.

Challenges of Remote WREAs. The above benefits should be understood in conjunction with the challenges employers face in implementing remote experiences. Based on participants' comments, one major challenge of remote opportunities is that not all employers can offer them. As Chelsea told us, "Well, the fact that we do not offer virtual internships has hindered us a little bit just because there's so many offers out there." This may not be a significant issue if the employer is looking for a specific type of worker (e.g., one who likes working outdoors), but it could prove more problematic for office-based employees whose work could be done remotely.

Employers who offered remote experiences expressed different challenges with the remote environment, and while each challenge may not have been shared widely, they collectively show some of the challenges that occur in the remote environment. Some participants expressed technical difficulties that ranged from distributing laptops to WREA participants to getting them secure access to the company's servers. Others discussed difficulties supporting students and trying to take steps to increase the "touchpoints" they had with WREA

participants. Bill said it was harder to know when students needed help. As he noted, “we noticed there was a lot more difficulty in making sure that they understood concepts well enough.” Bill explained that in person, you could show them quickly, but getting them “to admit that they don’t understand something over virtual was very difficult.” He explained that “they weren’t reaching out, so we saw probably a 20% decrease in what they were able to produce and understand by the end of the semesters.” To try and offset some of the concerns raised above, Bill explained that they increased the number of times they reached out to interns daily or every other day. Kendall shared that experience about needing to improve communication and created “focus groups” and “virtual happy hours” as communication tools.

More broadly, employers wanted to see from WREAs whether someone is a cultural fit for the organization. Kendall told us that this proved difficult in the remote environment:

I think the challenge for us, if you think about it from just a ground level, was the culture. I think everybody’s culture for your company took a hit. That’s one thing when I see a lot of interviews on site, I could bring them on site, they will feel the culture, they would you know meet different people, and you know kind of impromptu type of style, and we took a hit there.

Kendall’s point helps demonstrate the challenges that remote WREAs may provide for employers. If seeking to use WREAs as a hiring tool (as many of our employers do), then the extended interview aspect lessens when people are remote and you cannot see them as frequently. Cultural fit goes both ways, which means that students may be less able to evaluate their desire to work for an organization.

Similar to CCAs, employers made comments that recognized remote work is here to stay. Though employers noted benefits, remote WREAs also posed several challenges, requiring

employers to pause their programs or adapt them. Many did their best to adjust and demonstrated their commitment to improving the remote experience when they could. Interview comments indicated that some employers could not offer remote experiences or were unable to provide the same benefits to their students. While one employer halted their program due to concerns about quality, others grew through the experience and believed that they improved students' experiences while expanding their reach. We now turn to the student perspective.

Student Perspectives

Notwithstanding insights from CCAs and employers, comments from students provide a critical perspective on the benefits and drawbacks of remote WREAs. Their perspectives are essential in understanding how to better support their learning and development, which are among the primary benefits of WREA participation. Below, we provide preliminary results from ongoing student interviews.

Benefits of Remote WREAs. Based on comments offered in their interviews, students generally seemed to appreciate the flexibility and less restricted nature of remote opportunities. During interviews, students expressed an appreciation for flexible schedules (e.g., I can take a quick break when I want to and go to my kitchen for a snack) and less restrictive working conditions (e.g., I can wear more comfortable clothing and do not need to commute). For example, several students mentioned how much they dislike commuting and grew accustomed to saving money on gas through remote work. Some students had substantial commutes when they worked in a major city. For many students, remote WREAs offered flexibility in their schedules that in-person experiences did not. Work that is more flexible can open opportunities for students whose busy schedules are less flexible. With added flexibility, some students also mentioned having greater access to opportunities outside of the geographic location where they may

typically look or apply. However, it is important to note that increased access to WREAs via remote opportunities does not mean that all students have greater access to WREAs. As research shows, remote opportunities first require access to technology and high-speed internet access, among other considerations (Cabrera Rasmussen & Van Vechten, 2021; Hora et al., 2021). In addition to technology-related issues, students in our study communicated many added challenges.

Challenges During Remote WREAs. In their interviews, students suggested that for the benefits remote WREAs offered, several challenges associated with remote WREAs should be better understood. Interview participants and survey respondents discussed issues with interpersonal interactions, concerns about the quality of the experience, problems with the at-home environment, and beliefs that the remote experience was not entirely replicative of the in-person experience. For example, although students enjoyed the flexibility of working from home, many indicated concerns about the lack of social interaction and expressed feelings of isolation. Natalie, a computer engineering student, discussed this issue:

When you're in person, you're seeing other people. You're seeing your coworkers, but when you're working from home, it's just kind of you and your computer screen. So, I know a lot of people who wouldn't really like that, because they like to be around people. Being away from others also meant little support and guidance when needed. As opposed to working in person, wherein students can walk over to a colleague's office for answers to questions or general support, some students had trouble contacting help quickly and easily, resulting in work stoppages or frustration.

Living conditions also posed an issue for some who found it difficult to find sufficient space and quiet to do their work or struggle to focus on work outside of the work environment.

Jennifer, a computer engineering student, explained: “There’s a whole host of like (similar) students right now that are having to take, you know, these internships in their tiny rooms. You know, it was really a difficult environment to adjust to, you know, as students.”

Finally, some students expressed concerns about the quality of the experience. For example, Violet, an electrical engineering student, said she felt neglected during her experience due to the lack of structure. She was put on Zoom calls for her to learn something but knew so little about the projects the teams were working on that she gained little from the experience. Others found their remote experiences beneficial but felt they could have learned more in person.

Generally, despite the challenges, students seemed to remain open to remote work. Kristy told us that she would consider remote experiences. She said of remote, “I think if that’s like your only option, it’s fine. I mean it’s better than nothing, but I think in-person experiences like, looking back now, you learn more from it. And you can connect with people better.”

Discussion

Work-related experiential activities (WREAs) are a long-standing and important co-curricular activity that facilitates students’ access to successful employment. Recent events, including the ability (or lack thereof) for students to interact with others in an employment setting due to Covid-19 further spurred the possibility of remote experiential activities. This study examined findings from three stakeholder groups – administrators in college career centers (CCAs), employers, and students who engaged in WREAs in the fields of engineering and computer science. Findings indicate that recent work-related experiential activities that were completed remotely were neither perceived nor experienced as positively as the WREAs that were completed in person. Compared to respondents who completed their WREAs in person, remote WREAs were less likely to be taken by older and first-generation students. Survey

findings partially support Hora et al.'s (2021) findings that non-first-generation students were more likely to engage in a remote experience. We are unsure why Asian students were more likely than White students to favor remote WREAs. Perhaps some students travel to their permanent home further away and may find the remote option more desirable, but this is pure hypothesis at this point. While we cannot say why, it is also interesting to note that of the variables in our model, students were equally likely to participate in remote experiences as they were hybrid or in-person WREAs. Some of the survey questions help to show that student preferences (e.g., for rural or urban environments) can be associated with a student's engagement in different modalities. It seems plausible that students who value the ability to work from home would be expected to be more likely to participate in fully remote WREAs than the hybrid option, whereas students who valued the time it took to get to the WREA site might be expected to seek hybrid opportunities.

Qualitative interviews with CCAs, employers, and a select sample of students indicated similar views about the benefits and challenges of remote WREAs. CCA, employees, and students all held shared understandings that remote opportunities provide greater flexibility and, for some students, greater access to opportunities at a distance, but that flexibility and access may come at the cost of easy access to guidance and mentorship, social interaction and learning. Qualitative findings of the benefits and challenges of offering and participating in remote WREAs largely support prior research that suggests remote WREAs expand access geographically and provide flexibility in work but have some limitations in the quality of the experience, communication frequency and speed, and cannot always replicate the in-person experience (Bayerlein & Jeske, 2018; Bell et al., 2021; Cabrera Rasmussen & Van Vechten, 2021; Hora et al., 2021; Morrill Bijeau & Peters, 2021).

Future research should expand on our findings by interrogating student characteristics or preferences that may predict participation in one modality over another. Stakeholders would also benefit from more targeted interviews with those groups identified as more likely to participate in one type of modality over another to understand why those modes are preferable. Further, research should also explore participation rates in and perceptions of remote WREAs in other industries, institutions, or regions to understand similarities and differences between what we present here.

Implications for Practice

Like our CCAs, employers, and students, we believe that remote experiences will continue to be offered and increase in number as more people become comfortable with remote work and remote WREAs improve in quality. This will require sustained attention to the design, delivery, and accessibility issues that continue to limit the potential of remote opportunities.

From our data, we cannot say if remote experiences opened the doors to disadvantaged groups. However, prior scholarship suggests that barriers exist to participating in WREAs (Bathmaker et al., 2013; Dirienzo, 2016; Frenette et al., 2015; Hora et al., 2017, 2019; Hora, Chen, et al., 2020), and remote experiences may not always open access as predicted because barriers are not truly removed (Cabrera Rasmussen & Van Vechten, 2021; Hora et al., 2021). There is reason to continue to design the best experiences possible so that students can gain the most from their WREA engagements. However, the larger barriers to WREA participation will need to be addressed if equity is to be reached, given the few groups that choose to participate in in-person over remote experiences.

Our student participants suggested that hybrid opportunities may be the best way forward for some students. Occasional trips into the office could alleviate many of the challenges faced in

the remote environment (e.g., isolation or lack of replicability of some tasks) while still providing flexibility. Some students felt that had they been onboarded in person, they could have easily done the work that they were tasked with, but without that initial support, they felt lost. This may not be possible for students in locations with fewer opportunities or working outside of a reasonable drive. For employers, this may also lessen the geographic reach benefit.

We agree with Hora et al. (2021) on the importance of intentionality when designing remote experiences. Bayerlein and Jeske (2018) suggested that industry differences are important to consider when designing and implementing remote WREAs. Our findings suggest that student preferences are important when considering who may benefit from or thrive in a remote environment. To provide students with high-quality WREAs, practitioners must account for student needs and industry expectations to ensure that the WREA benefits them and translates into a positive outcome. Mark V., a CCA, described employers as “loose” with their designation of a remote experience. As such, higher education institutions will need to work with students and employers to help better support and structure these experiences to fit the student’s needs better. Our employer participants expressed the value in improving the quality of their experiences and were actively looking for ways to do so. Students with remote WREAs did not always find that the experience was intentionally designed. While students should self-advocate, when necessary, we do not believe that they should be solely responsible for ensuring their experiences meet their needs. This suggestion spans modality, recognizing that quality experiences of all types need intentionality. Given the unique challenges of being remote, intentionality becomes more pressing.

With intentionality, it is crucial to keep in mind that rather than encourage one modality over another, the WREA should be to the primary benefit of the student and selected and

designed to meet their needs. While some experience may be better than no experience, the experience should fit the student's needs and put them in a situation where they can thrive regardless of modality. Higher education institutions and students should work together to identify student preferences and needs to ensure a good fit and then work with the employer to ensure the experience will meet those goals.

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Table 1*Descriptive Statistics of Survey Respondent Characteristics*

| Baseline Characteristic | N | Percent of valid responses |
|---------------------------|-------------|----------------------------|
| Gender | | |
| Male | 677 | 54.9 |
| Female | 548 | 44.4 |
| Race | | |
| White | 590 | 47.0 |
| Black or African American | 98 | 7.8 |
| Hispanic | 102 | 8.1 |
| Asian | 373 | 29.7 |
| Other | 93 | 7.4 |
| First Generation | | |
| Yes | 192 | 15.5 |
| No | 1046 | 84.5 |
| Major | | |
| Computer Science | 404 | 30.7 |
| Engineering | 914 | 69.3 |
| WREA required by major | | |
| Yes | 162 | 11.3 |
| No | 873 | 61.1 |
| Unsure | 394 | 27.6 |
| Participated in WREA | | |
| Yes | 643 | 45.4 |
| No | 774 | 54.6 |
| Financial Aid | | |
| Need-Based | 260 | 20.9 |
| Merit-Based | 788 | 63.4 |
| Educational Loan | 334 | 26.9 |
| No Financial Aid | 278 | 22.4 |
| Mean Age | 21.9 (2.45) | |
| Mean GPA | 3.55 (.45) | |

Note. Ns include all valid responses to each question; they do not include respondents who did not identify for the category. The total number of valid survey respondents was N=1,447. Due to rounding, percentages may not total 100.

Table 2*Employer Participant Primary Area of Hiring, Industry, and Remote Experience*

| Name | Primary Area of Hiring | Industry | Experience with Remote WREAs or Work |
|---------|----------------------------------|--------------------------------------|--------------------------------------|
| Aidan | Computer Science | Cryptocurrency/Decentralized Finance | X |
| Bill | Computer Science | Insurance | X |
| Gabe | Computer Science | Health Care Technology | X |
| Jessica | Computer Science | Technology | X |
| Kendall | Computer Science | Data Processing | X |
| Paul | Computer Science | Technology | |
| Pete | Computer Science | Restaurants | X |
| Suzie | Computer Science | Insurance | X |
| Danna | Engineering and Computer Science | Recreational products | X |
| Mary | Engineering and Computer Science | Financials | X |
| Chelsea | Engineering | Utilities | |
| Chris | Engineering | Aerospace Engineering | |
| Christy | Engineering | Construction | |
| Jackie | Engineering | Construction | |
| Jacob | Engineering | Engineering & Heavy Civil | |
| Jordyn | Engineering | Engineering Consulting | |
| Mark | Engineering | Aerospace Engineering | |
| Nathan | Engineering | Construction | |
| Steve | Engineering | Electrical Contractors | |
| Vivian | Engineering | Transportation (Public Sector) | |
| Woody | Engineering | Engineering Consulting | |

Note. All names are pseudonyms. Industry and Primary Area of Hiring were based on information sheets

and interview data. We use participant descriptions when possible. Danna works for a company and overseas areas that hire both engineers and computer scientists. Mary's organization hires from multiple majors and fields, feeling that a specific major is less important than attitude and general competency. We had two instances of people working at the same company (Bill and Suzie, and Chris and Mark).

Table 3*General WREA Activities for Survey Respondents*

| Characteristic | N | Percent of valid responses |
|--|-----|----------------------------|
| More than one WREA | | |
| Yes | 643 | 45.4 |
| No | 774 | 54.6 |
| WREAs completed since entering college | | |
| One | 258 | 40.6 |
| Two | 213 | 33.5 |
| Three | 106 | 16.7 |
| Four | 38 | 6.0 |
| Five | 21 | 3.3 |
| Remote or In-Person WREA | | |
| Remote | 240 | 27.3 |
| In-Person | 480 | 54.6 |
| Both | 159 | 18.1 |
| Average Hours per Week spent on WREA | | 34.85 (11.06) |

Note. Ns include all valid responses to each question. They do not include respondents who did not

identify for the category. The total number of valid survey respondents was N=1,447. Due to rounding, percentages may not total 100.

Table 4*Factors Contributing to Student Participation in WREAs by Modality*

| Variable | <i>B</i> | Std error | <i>Exp(B)</i> |
|---|----------|-----------|---------------|
| In-Person | | | |
| Black | 0.063 | 0.382 | 1.065 |
| Asian | -0.597 | 0.225 | 0.551** |
| Hispanic | -0.103 | 0.322 | 0.903 |
| Other Racial Category | 0.374 | 0.356 | 0.1454 |
| Age | 0.288 | 0.084 | 1.333*** |
| First Generation | 0.983 | 0.360 | 2.674** |
| Female | -0.191 | 0.176 | 0.826 |
| Need-Based Financial Aid | -0.104 | 0.255 | 0.901 |
| Merit-Based Financial Aid | 0.512 | 0.307 | 1.669 |
| Loan | 0.185 | 0.262 | 1.203 |
| No Financial Aid | 0.645 | 0.372 | 1.906 |
| Time it takes to get to WREA | 0.331 | 0.097 | 1.393*** |
| Ability to work from home | 0.435 | 0.110 | 0.647*** |
| Rural setting | 0.262 | 0.131 | 1.299* |
| Urban setting | -0.234 | 0.096 | 0.791* |
| Access to public transportation | -0.140 | 0.107 | 0.869 |
| Access to parks & recreation | -0.086 | 0.104 | 0.917 |
| Access to shopping | 0.009 | 0.014 | 1.009 |
| Close to family/friends | 0.093 | 0.092 | 1.098 |
| Both Remote & In-Person (Hybrid) | | | |
| Black | -0.213 | 0.490 | 0.808 |
| Asian | -0.422 | 0.281 | 0.656 |
| Hispanic | -0.350 | 0.424 | 0.705 |
| Other Racial Category | 0.231 | 0.440 | 1.260 |
| Age | 0.237 | 0.099 | 1.267* |
| First Generation | 0.820 | 0.444 | 2.269 |
| Female | 0.180 | 0.218 | 1.198 |
| Need-Based Financial Aid | -0.149 | 0.317 | 0.861 |
| Merit-Based Financial Aid | 0.903 | 0.399 | 2.468* |
| Loan | 0.445 | 0.317 | 1.560 |
| No Financial Aid | 0.785 | 0.481 | 2.192 |
| Time it takes to get to WREA | 0.256 | 0.120 | 1.292* |
| Ability to work from home | -0.280 | 0.134 | 0.756* |
| Rural setting | 0.072 | 0.160 | 1.075 |
| Urban setting | -0.063 | 0.121 | 0.939 |
| Access to public transportation | -0.101 | 0.134 | 0.904 |
| Access to parks & recreation | -0.191 | 0.136 | 0.826 |
| Access to shopping | 0.054 | 0.095 | 1.055 |
| Close to family/friends | 0.071 | 0.113 | 1.074 |

Note. Remote WREAs and White students are the reference groups.

*** $p < .001$, ** $p < .01$, * $p < .05$