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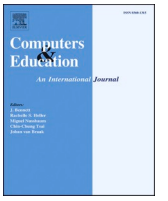

Virtual internships as alternative work-based learning: Examining access, quality, and outcomes for underserved students☆,☆☆

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A B S T R A C T

This study examines whether virtual internships serve as a viable alternative to in-person work-based learning opportunities, and, if so, for whom and in which specific dimensions. Drawing on a large-scale survey (N=11,009) and administrative data collected from 17 U.S. postsecondary institutions during the 2020-2021 academic year, the research compares the experiences of historically marginalized students in virtual and in-person internships to those of their non-marginalized counterparts across access, program quality, and outcomes. Findings from a Latent Profile Analysis indicate that while most virtual interns (86%) participate in programs of comparable quality to in-person formats, this parity breaks down at the extremes, with virtual interns overrepresented in under-resourced experiences and underrepresented in high-quality, long-term placements. Regression analyses further reveal that racial minorities and students with moderate work commitments experience smaller gaps in either participation, learning quality, or outcomes in virtual internships. However, rural students, other racial minority groups, women, and those with extensive work commitments face equivalent or amplified barriers in either access to or quality of virtual learning experiences. These asymmetrical distribution patterns highlight important nuances concerning technology-fueled internships as universal equity solutions, offering implications for stakeholders designing inclusive work-based learning ecosystems.

1. Introduction

Internships represent an increasingly powerful form of Work-Based Learning (WBL)—a pedagogical approach that situates students in authentic work settings to learn through experiential practice (Bailey et al., 2004). In these roles, students apply disciplinary knowledge, hone technical skills, and cultivate professional dispositions. The prevalence of these experiences has grown substantially, with nearly 70.5 % of undergraduates in the U.S. in 2017 having participated in at least one internship before graduation (Shandra, 2022). Empirical evidence demonstrates that such placements yield multifaceted benefits, such as enhancing academic achievement (Binder et al., 2015) and accelerating professional identity development (Ocampo et al., 2020). In the labor market, students have had higher probabilities of job interviews (Nunley et al., 2016) and offers (Baert et al., 2021), expedited transitions into full-time employment, closer skill–job match, and superior earnings trajectories (Di Meglio et al., 2022).

Despite their growing importance, research highlights a critical disparity in this landscape: students from historically marginalized communities remain significantly underrepresented in traditional in-person internships (Hora, Wolfgram, Huerta, et al., 2022). Contemporary global phenomena, such as COVID-19, natural disasters, and shifting labor market conditions, have further introduced challenges for these students to cultivate career-relevant competencies, build professional connections, and refine their intellectual and vocational aspirations through these opportunities (Ross et al., 2020; Wheeler & Waite, 2023). This is concerning given

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internships' critical role in shaping future career trajectories.

The advent of virtual internships—digitally mediated WBL experiences conducted remotely (Hora et al., 2021)—has sparked scholarly discourse on their potential to mitigate structural inequalities in traditional, place-based internships. Proponents argue that the flexibility of digital platforms may democratize access (e.g., Kraft et al., 2019; Reid et al., 2023), particularly for marginalized populations who face barriers such as relocation costs, unpaid positions, limited professional networks, and unfamiliar workplace norms. Indeed, federal initiatives like Virtual Student Federal Service Internships explicitly target "students who might not otherwise be able to participate in an in-person [federal service] internship." (U.S. Department of State, 2023).

However, skeptics caution that virtual internships may replicate or even exacerbate existing disparities, arguing that they may merely be an online adaptation of traditional internships. Digitally mediated environments often demand robust technology infrastructure and skills, a contextualized working setting, and interpersonal training (Jeske & Axtell, 2014), all of which can complicate efforts to provide high-quality learning experiences with structured mentorship, clear objectives, and meaningful workplace interactions (Bayerlein, 2015; Teng et al., 2021). Just as poorly structured traditional internships can create negative professional perceptions (Kim & Park, 2013), inadequately designed virtual placements may amplify psychosocial distress and suppress career aspirations, especially for individuals facing higher opportunity costs. This may, in turn, hinder societal progress by disrupting inclusive workforce pipeline and development, thereby potentially undermining educational efforts to promote social mobility.

The divergent theoretical perspectives on virtual internships have led scholars and policymakers to question whether they represent a transformative solution for mitigating structural barriers faced by underrepresented students. Although small-scale studies offer mixed findings for underrepresented students (e.g., Arastoopour et al., 2014; Jenkins et al., 2023), large-scale empirical evidence remains scarce on virtual internships' potential to broaden access for students unable to pursue traditional placements. This scarcity reflects the relatively limited pre-pandemic availability of virtual internships. More evidence is also needed to determine whether virtual internships offer developmental outcomes, satisfaction levels, or learning experiences comparable to in-person formats—and for whom. In the absence of robust evidence, policy debates on leveraging virtual internships to advance educational and workforce equity remain unresolved.

This study addresses these gaps by analyzing data from a large-scale national survey of college students ($N = 11{,}009$) from 17 U.S. postsecondary institutions during the 2020–2021 academic year. Focusing on students historically underrepresented by race and ethnicity, gender, socioeconomic status, and rural geography, this study asks:

RQ1. To what extent do students with marginalized identities differ from their non-marginalized peers in their likelihood of participating in no internship, in-person internships, or virtual internships?
RQ2. To what extent do marginalized interns differ from their non-marginalized peers in their likelihood of experiencing various profiles of learning quality in virtual and in-person internships?
RQ3. To what extent do marginalized interns differ from their non-marginalized peers in their developmental outcomes and satisfaction from virtual and in-person internships?

By tracing how marginalized students navigate virtual versus traditional internships—from initial access through multidimensional learning quality to career outcomes—this study provides novel and comprehensive evidence on whether virtual formats fulfill their equity promise or merely replicate existing inequities. Additionally, this study identifies which student benefit and where gaps persist, offering evidence-based guidance for educators, employers, and policymakers seeking to leverage virtual formats as pathways to a more inclusive workforce.

2. Literature review

For this study, "historically marginalized students" is used as an umbrella term for groups underrepresented in higher education and professional career paths due to systemic barriers. This includes students of color, women, those from lower socioeconomic backgrounds, and individuals from rural areas. The challenges these students face are not monolithic, ranging from resource-based obstacles to identity-based threats experienced in the workplace. This review, therefore, explore both the distinct and overlapping ways in which internship modality interacts with these varied dimensions of identity and circumstances. In parallel, a "high-quality" internship program is defined as a WBL opportunity designed to foster meaningful engagement by enabling interns to acquire technical and professional skills, build social capital, and experience psychological safety within supportive working conditions and professional environment.

2.1. Access and opportunity structures: promises and challenges

Advocates posit that the virtual internships may democratize access by mitigating the geographical and temporal constraints of traditional on-site programs. Students from marginalized backgrounds face substantial obstacles including relocation costs, unreliable transportation, caregiving responsibilities, and limited local opportunities (Curiale, 2009; Hora, Wolfgram, Chen, et al., 2022; Jacobson & Shade, 2018). Start-ups or smaller organizations face similar challenges: limited physical infrastructure, geographic isolation from intern pools, and reduced visibility to applicants (Jeske & Axtell, 2014). By removing the requirement of physical co-location, virtual internships can lower relocation expenses (Pretti et al., 2020), minimize productivity losses from long commutes (Ma et al., 2024), and enable students to better balance internships with employment or caregiving demands (Waters & Russell, 2016). These benefits can be particularly acute for students of color and those from low-income households, who often face greater travel

distances and logistical challenges (The White House, 2021). Indeed, emerging evidence indicates that students who have faced longer commutes to traditional worksites report higher satisfaction with virtual internship arrangements (Januszewski & Grzeszczak, 2021). Collectively, these shifts may broaden participation for both students and hosts, expanding the scale and diversity of internship opportunities.

These accessibility gains may extend into recruitment practices as well. Virtual internships often utilize open, digitized platforms that can theoretically reach a broader applicant pool than conventional campus-based recruiting or referral networks (Jeske & Axtell, 2014), which tend to favor students with privileged social and cultural capital (Rivera, 2016). These entrenched networks can function as mechanisms of 'opportunity hoarding' where dominant groups restrict access outside privileged circles (Boulton, 2015; Smith & Green, 2021). By contrast, the cross-institutional and geographically diffuse structure of virtual internships may partially loosen the grip of proximity-based and socially exclusive referral systems.

However, structural openness alone may not ensure equitable access. Participation depends not only on formal recruitment channels but also on digital infrastructure, with reliable high-speed internet, adequate hardware, prior experience with digital tools, and institutional support unevenly distributed across rural, low-income, and marginalized communities (Jenkins et al., 2023; Li & Ranieri, 2013). Moreover, successfully navigating virtual recruitment processes often requires guidance to interpret unclear job postings, understand expectations, and tailor application materials supports often less accessible to students from non-traditional backgrounds (Halpern et al., 2020). Even when applicants reach the evaluation stage, the promised openness of digital platforms does not inherently neutralize bias in selection. For instance, employers may continue to prioritize institutional prestige, with manual or algorithmic screening processes reinforcing exclusionary patterns and disadvantaging candidates from outside elite institutions (Raghavan et al., 2020). Thus, platform openness alone may soften—but may not fully eliminate—the structural barriers embedded in internship access.

2.2. Learning environments: balancing psychological safety and social capital

Beyond access, virtual internships may offer distinct psychological advantages for marginalized students navigating professional environments. In face-to-face settings, particularly within homogenous industries, interns from underrepresented groups often encounter biased task assignments (Gracia, 2009), diminished belonging, and microaggressions that trigger identity-based self-monitoring, ultimately detracting from learning and development (Boulton, 2015). Emerging evidence suggests that virtual settings may attenuate some of these pressures. Grounded in gender frame theory—which posits that social interactions are often interpreted through subconscious, gender-based expectations—Doering and Tilcsik (2025) show that women report lower levels of everyday gender discrimination when working remotely. This is presumably because diminished visibility of gender cues limit opportunities for bias. Comparable patterns surface for other groups: women engineering interns in virtual programs have demonstrated enhanced professional efficacy and motivation in virtual contexts, an effect not found for male peers (Arastoopour et al., 2014); Asian and Black professionals reported fewer discriminatory encounters on remote workdays, both at work and in transit (Vinluan & Kraus, 2025); and Black and Hispanic students report more positive employer interactions than White peers during virtual recruitment events (National Association of Colleges and Employers [NACE], 2021). While underlying mechanisms likely vary across identities and contexts, the accumulating evidence suggest that virtual internships may create psychologically safer environments that support deeper learning engagement for marginalized students.

This potential gain in psychological safety, however, may come at the cost of social capital formation. Rich mentorship and peer networking—critical elements of professional socialization—often depend on frequent, organic interactions that are difficult to replicate in virtual settings (Hill et al., 2009). The resulting "virtual distance," marked by missing non-verbal cues, irregular communications, and the potential for misinterpretation, can weaken the development of rapport between interns and mentors (Jeske & Axtell, 2014) and, as in the broader remote workforce, may limit the career benefits that flow from informal contact with senior leaders (Yarberry & Sims, 2021). Thus, without intentional scaffolding by organizations, virtual interns may experience poorer teamwork, reduced motivation, and weaker developmental outcomes (Jeske & Axtell, 2014; Teng et al., 2021). Interestingly, this trade-off may not be universally experienced. Research with Asian women participating in internships found that while they noted the absence of traditional office socialization, this did not appear to undermine their satisfaction or learning outcomes (Baker & Fitzpatrick, 2022).

2.3. Preconditions for equity: program design and learning quality

Embedded within discussions of access and experience is a foundational assumption—the expectation that, when well executed, remote placements can yield learning experiences and developmental benefits at least comparable to those of on-site programs. Without this premise, any examination of differential experiences risks being overshadowed by more fundamental concerns about program efficacy.

Initial evidence presents a mixed portfolio regarding the parity premise. Optimistic findings suggest virtual internships can deliver quality learning experiences characterized by substantial skill acquisition, albeit requiring greater resource and planning than traditional placements (Yarberry & Sims, 2021). For example, virtual hospitality interns reported applying classroom knowledge to real management scenarios while developing skills unavailable in traditional settings (Park & Jones, 2021). Analysis of 158 virtual interns shows that those receiving mentorship report significantly greater skill development than non-mentored peers, particularly in communication, collaboration, and strategic problem-solving (Jeske & Linehan, 2020). Programs featuring regular, structured communication, clearly defined projects, and strong supervisory support achieve satisfaction levels, confidence gains, and skill development comparable to traditional formats (Gao et al., 2019; Ruggiero & Boehm, 2016).

Conversely, parallel evidence cautions that digital expansion might have stretched the lower tail of internship quality, particularly regarding high-touch engagement and structural working conditions. While virtual placements may achieve parity in technical skills development, some internship hosts struggle to replicate the rich, spontaneous, and immersive environment of physical workplaces, which is the primary incubator for tacit knowledge, social capital, and organizational enculturation (Perkins & Irwin, 2023). In fact, only about half of hospitality interns in pandemic-era virtual placements felt prepared them for full-time work, citing curtailed networking and slow feedback (Park & Jones, 2021). This divide is reinforced by reports of disproportionately challenging working conditions in remote internships, including long hours that create a detrimental work-life balances and contribute to negative mental health outcomes for interns (UN Today, 2022). This quality divide is particularly concerning because students from marginalized backgrounds—who depend most heavily on internships to build professional capital yet are least equipped to navigate remote work's ambiguities—may be systematically directed toward lower-quality placements, ultimately undermining virtual internships' equity promise.

2.4. Present study

Recognizing the unusually sophisticated nature of equity potentials in virtual internships, the present analysis built on two insights from the current evidence base. First, most investigations focus on a single stage of the internship experience—access, day-to-day learning, or post-program outcomes. This created an opportunity to trace equity dynamics as students moved from recruitment to completion. Second, internship "quality" was typically operationalized with a lone variable (e.g., feedback frequency or compensation) or an additive mean, even though theory and practitioner guidance described quality as multidimensional (D'Abate et al., 2009). A more nuanced approach can reveal the diverse configurations students actually face, including high-mentorship placements with clearly defined goals but poor working conditions, or well-compensated roles with limited networking and supervisory support. For this reason, the present study illuminates how virtual placements fit within the broader landscape of internship experiences.

To capture such complexity, the study followed a three-step design. RQ1 tested patterns of access to virtual and in-person internships and then contrasts these patterns for historically marginalized and non-marginalized students. Conditional on access, RQ2 employed latent-profile analysis on eleven evidence-based indicators to recover distinct quality typologies common to both modalities and to examine differential sorting patterns across student groups and modalities. Finally, marginalization status, together with modality, was linked to developmental outcomes and overall satisfaction after controlling for learning quality-based typology membership. By examining the internship experience as a multi-stage, multi-dimensional pipeline, the study moved the debate from a simple "virtual-versus-in-person" dichotomy to reveal how entry into virtual versus on-site roles, the specific configuration of task, supports, and working conditions contained in those roles, and the developmental gains that follow are intertwined. This shift provided essential information for educators, employers, and policy-makers seeking to leverage virtual internships as a genuine instrument of workforce equity.

3. Data and methods

3.1. Data and sample

The dataset combined three data sources: 1) 2020–2021 National pilot survey data from 17 U.S. higher education institutions; 2) geospatial data from the Education Demographic and Geographic Estimates Program (EDGE); and 3) Institution administrative data from the Integrated Postsecondary Education Data System (IPEDS).

For the survey, a nonrandom sampling approach was used to recruit institutions, inviting all undergraduate students to complete an anonymous online questionnaire. Distributed between December 2020 and March 2021, the web survey resulted in an overall response rate of 4.53 %, drawing responses from 12,130 participants. To focus on each internship modality within the U.S., 1121 respondents were excluded, including those who experienced both remote and on-site work, those who completed high school outside the U.S., or those who returned to their home countries during data collection.

As Table A.1 shows, the final analytical sample consisted of 11,009 college students from 12 public and 3 private four-year institutions, and one public and one private two-year institution. Examination of the sample revealed significant variations in student characteristics compared to nationally representative undergraduates. For example, the final sample consisted of a significantly lower proportion of men (27.38 %, $n = 3012$), compared to women (69.62 %, $n = 7664$). By race and ethnicity, white students constituted the largest group in the samples (62.88 %, $n = 6923$), followed by Asian (13.02 %, $n = 1453$), Hispanic (10.32 %, $n = 1136$), and other races (8.10 %, $n = 892$). One in five respondents (20.50 %, $n = 2257$) reported having taken at least one internship during the past 12 months. The proportion of interns who participated in in-person positions (50.78 %, $n = 1146$) was comparable to those who engaged in virtual internships (49.22 %, $n = 1111$), with distribution reflecting a nearly even split between the two modalities. Although the low response rate and sample imbalance limit generalizability, the large-scale dataset—with comparable numbers of in-person and remote interns—remained a valuable resource for addressing the research questions and tracing internship trajectories within a single study. More importantly, the data captured the unique 2020–21 period when virtual internships rapidly expanded due to pandemic necessities, creating an irreplaceable natural experiment for comparing both modalities at institutional scale.

3.2. Measures

Table 1 displays an overview of the variables capturing college students' experiences related to internships and their backgrounds,

as collected through an online questionnaire. Building on D'Abate et al.'s (2009) synthesis of internship quality for undergraduate students in Management and Business classes, the framework used in this study drew upon three interconnected research foundations.

First, the Job Characteristics Model (Hackman & Oldham, 1974) highlights the intrinsic motivational potential of the work itself, arguing that tasks are more engaging when they offer skill variety, task identity (i.e., completing a whole piece of work), task significance, autonomy, and direct feedback. Second, work environment theories (e.g., Steers & Porter, 1991) broaden this scope, underscoring how the surrounding organizational milieu including the nature of supervisory support, peer interactions, organizational climate, and resource availability shapes employee attitudes and behaviors beyond the specific tasks assigned.

Finally, complementing these ideas, the framework incorporated structural arrangements as a third critical foundation. These arrangements, recognized as fundamental components influencing perceptions of job quality more broadly, are pertinent to the internship's context as well. Research indicates, for instance, compensation practices significantly predict internship developmental value and satisfaction (McHugh, 2017). Similarly, the structure of work hours is consequential, with findings highlighting that reasonable and clearly defined weekly commitments contribute positively to learning and well-being (Reid et al., 2023). The sufficient duration also enables deep engagement, skill development, and professional socialization (Bailey et al., 2000).

This synthesis yielded eleven key characteristics, established in the literature as critical indicators of high-quality developmental experiences. The framework include: Task characteristics (clarity of goals, relevance to academic study, incorporation of soft skills development); supervisory support and style (supervisor's mentoring on job duties, use of autonomy-supportive learning strategies, emotional support from field supervisors, advising support from academic staff, opportunities for professional networking); and structural working conditions (compensation, hourly commitment, duration). Survey items were drafted or drawn from validated instruments and then refined through pre-testing, expert reviews, and focus group feedback (see Table A.2 in Online Supplementary Material for more details on measures, literature, and coding). These scales produced favorable internal reliability, ranging from 0.78 to 0.89 of Cronbach's Alpha.

3.3. Analytical strategies

Fig. 1 illustrates the research model employed in the present study. To address the first research question, multinomial logistic regression was used to assess whether students from marginalized identities have differing likelihoods of participating in: 1) an in-person internship vs. none; 2) a virtual internship vs. none; and 3) a virtual vs. an in-person internship. Internship engagement was modeled as a function of individual characteristics and institutional contexts. The primary marginalized student groups of interest were categorized by their race and ethnicity (Asian, Black or Hispanic, other races, and White), gender (women or men), socio-economic status (caregivers' income and students' employment status), and high school location (rural vs. non-rural). Confounding factors such as GPA, first-generation status, prior work-based learning experiences (e.g., co-ops and apprenticeships), grade level, and age were controlled throughout the study. Recognizing that the feasibility of virtual internships varies across academic fields (Pretti et al., 2020), the control for students' academic programs was also included. Institution-specific factors potentially influencing internship participation were captured through institution-fixed effects, with standard errors clustered at the institution level.

In the second part, Latent Profile analysis (LPA) was employed to investigate how internship program quality profiles differed between marginalized and non-marginalized students across virtual and in-person internship modalities. This person-centered,

Table 1
Overview of internship experience variables and student characteristics.

Theme	References	Description
Internship access		
Internship participation		Internship participation in the past 12 months (yes/no); If not, interested in participating (yes/no)
Modality		Modality (in-person, virtual, others)
Quality of the internship program		
Task-related pedagogical dimension	Beenen & Rousseau, 2010; McHugh, 2017; Taylor, 1988	Clarity of learning goals (2 items; $\alpha = 0.8$), academic relevance, Incorporation of soft skills development (4 items; $\alpha = 0.78$)
Supervisory support and style dimension	Beenen & Rousseau, 2010; McHugh, 2017; Shanock & Eisenberger, 2006	Supervisor mentoring on job duties (4 items; $\alpha = 0.83$), use of autonomous learning strategies (2 items; $\alpha = 0.81$), emotional support from field supervisor (4 items; $\alpha = 0.89$), support from academic staff, professional networking opportunities
Structural working condition dimension	Bailey et al., 2000; McHugh, 2017; Reid et al., 2023	Paid or unpaid, log-transformed hourly compensation, number of working hours per week/10, number of working weeks/10
Internship outcomes		
Developmental value and satisfaction	McHugh, 2017; Nghia & Duyen, 2019	Academic developmental value (5 items; $\alpha = 0.88$), career developmental value (5 items; $\alpha = 0.89$), satisfaction
Student characteristics		
Student characteristics	Kochhar & Sechopoulos (2022)	Race and ethnicity (Asian, Black, Hispanic, White, or others), gender (women, men, or others), two types of socio-economic status indicator: 1) student employment status (no employment, weekly work hours $\leq$20, weekly work hours >20) and 2) caregivers' income level (low-, middle-, high-, or unknown income group), high school geographic profile (rural or non-rural), first-generation status, academic program (Business, STEMM, Arts, others), advanced academic standing, GPA, other WBL experiences, age

Note. See Table A.2 in the online supplementary material for details.

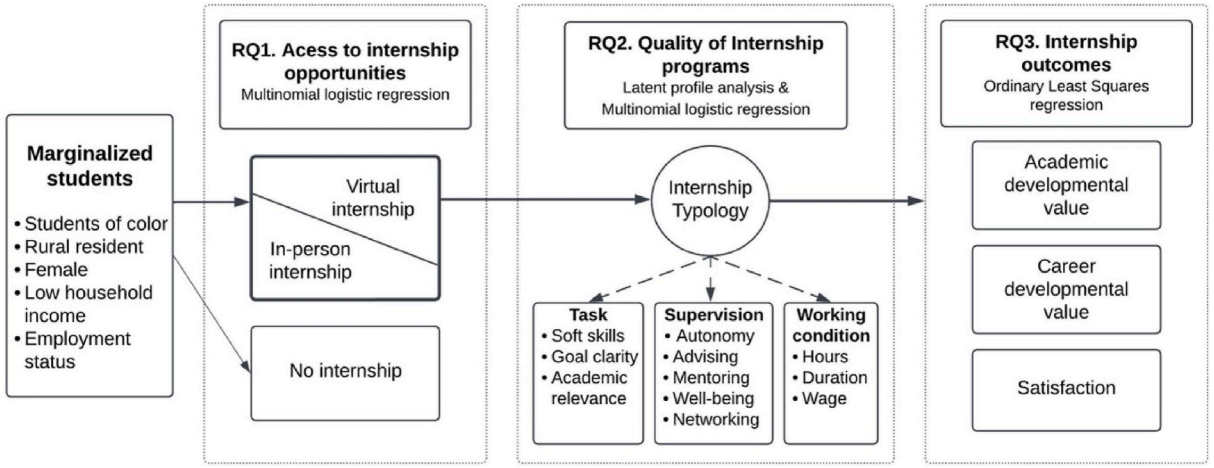

Fig. 1. Research model of the current study.

probability-based clustering technique allowed for the identification of distinct intern profiles by examining multiple variables simultaneously (Kim et al., 2021; Suárez-Perdomo et al., 2022). This approach is particularly suitable for this study as it allows for the detection of homogeneous groups of interns who share similar internship experiences. The analysis began by identifying distinct intern profiles based on three dimensions of internship programs—task characteristics, supervisory support and style, and contextual working conditions. These dimensions were operationalized using the eleven quality indicators outlined in Table 1, encompassing both virtual and in-person internships. By examining these indicators, LPA facilitates the identification of distinct quality profiles that reflect varying configurations of task design, supervisory support, and working environment.

The LPA process unfolded in two main stages: First, the optimal number of intern profiles was identified through a series of exploratory processes that find a model with the best model fit. Following the determination process suggested by Magidson and Vermunt (2004) and Nylund et al. (2007), models were fitted with an increasing number of latent classes and the fit of each model was evaluated. Three commonly used statistics were compared to the selection of the correct number of classes: Bayesian Information Criteria (BIC), Lo-Mendell-Rubin (LMR) adjusted likelihood test, and the percentage reduction in the likelihood ratio chi-square statistic (L^2) as opposed to the unconditional measurement model. Additionally, theoretical interpretability of competing models was reviewed to identify conceptually meaningful subgroups (B. O. Muthén & Muthén, 2000; Nylund et al., 2007). This stage also contained sorting each respondent into a latent cluster based on their estimated posterior class membership probabilities (Masyn, 2013).

With intern profiles defined, multinomial logistic regression was used to assess how the internship experiences of marginalized interns differed from those of their non-marginalized counterparts across virtual and in-person settings. Profile assignment served as the dependent variable, with interaction terms between virtual modality and marginalized identity status functioning as predictors. Further analyses of these interaction effects were run separately for virtual and in-person interns to fully understand the nature of this moderated relationship. Comparison of the distribution of historically underserved students across internship quality profiles illuminated whether the quality gaps observed in in-person internships between marginalized and non-marginalized students are reduced, maintained, or potentially exacerbated in virtual settings.

The final part of the study addressed the third research question, which examined how the career or academic developmental values, and satisfaction of marginalized interns differed from those of their non-marginalized counterparts across virtual and in-person settings. Ordinary Least Squares regressions were conducted to statistically compare the mean values of internship outcomes between intern groups with varying modalities, while controlling for the above student characteristics. Latent profile memberships were included as covariates to account for variations in outcomes linked to program quality or the uneven distribution of marginalized students across internships of varying quality, clarifying the role of internship modalities for marginalized groups.

4. Results

4.1. Research question 1: Internship access, marginalized identities, and modality associations

Table 2 presents multinomial logistic regression results, examining if virtual internships provide alternative access for marginalized students relative to traditional in-person internships. For ease of interpretation, results are expressed as relative risk ratios; values above 1 suggest an increased risk of the corresponding group over the reference group, while a ratio below 1 indicates a higher risk of belonging to the reference group.

Estimates in Model 1 reveal significant disparities in students' participation in onsite internships, with Asian students having 46 % ($p < 0.001$) and Black or Hispanic students 25 % ($p < 0.05$) lower odds to engage in place-based positions than White peers. Middle and lower-income students also have 14 % ($p < 0.01$) and 16 % ($p < 0.05$) lower odds, respectively, than those from upper-income families.

Table 2
Multinomial logistic regression estimates predicting access to internships.

	Model 1	Model 2	Model 3
	In-person vs. no internship	Virtual vs. no internship	Virtual vs. in-person internship
	RRR (*S.E.*)	RRR (*S.E.*)	RRR (*S.E.*)
Race/ethnicity			
Asian	0.54*** (.08)	1.28** (.12)	2.36*** (.36)
Black or Hispanic	0.75* (.09)	1.26** (.1)	1.68*** (.23)
Other race and ethnicity	0.97 (.09)	1.08 (.1)	1.11 (.13)
Gender			
Women	1.06 (.06)	0.99 (.05)	0.93 (.07)
Geographic background			
Rural background	1.18 (.11)	0.82* (.07)	0.69*** (.07)
Caregivers' income			
Middle income	0.86** (.04)	0.78* (.09)	.91 (.11)
Lower income	0.84* (.07)	0.82 (.13)	.98 (.11)
Unknown income	0.77 (.09)	0.86 (.11)	1.12 (.13)
Employment status			
Weekly work hours >20	0.49*** (.08)	0.41*** (.03)	.85 (.12)
Weekly work hours ≤20	0.65*** (.06)	0.71*** (.06)	1.09 (.17)
Intercept	0 (0)	0 (.69)	.04 (.02)
Pseudo R^2	0.16		

Note. ***$p < 0.001$, **$p < 0.01$, *$p < 0.05$. $N = 10{,}289$. RRR=Relative Risk Ratio. *S.E.*=Standard Error. Complete model results are shown in the online supplementary material, Table A.3.

Moreover, students working over or under 20 h encounter 51 % ($p < 0.001$) and 35 % ($p < 0.001$) reduced odds, respectively, of participating in in-person internships, with no significant variation by gender or geographical background. Conversely, Model 2 reveals a different dynamic for virtual internships, showing higher odds of participation for Asian, Black, or Hispanic students by 28 % ($p < 0.01$) and 26 % ($p < 0.01$), respectively, over White students. However, students from rural high schools and middle-income families face 18 % ($p < 0.05$) and 22 % ($p < 0.05$) lower odds, respectively. Furthermore, the odds of engaging in a virtual internship fall by 59 % ($p < 0.001$) and 29 % ($p < 0.001$) for students working over or under 20 h. Model 3 further dissects the accessibility landscape, illustrating the higher odds of Asian, Black or Hispanic students engaging in virtual rather than in-person internships—136 % ($p < 0.001$) and 68 % ($p < 0.001$) higher odds, respectively. The geographic setting is also a key factor, with students from rural areas experiencing 31 % ($p < 0.001$) reduced odds of participating in virtual internships compared to in-person ones.

Together, these findings suggest that virtual internships may represent a more accessible WBL avenue for students from marginalized racial and ethnic groups. Nonetheless, they appear to play only a limited role in reducing gaps in internship participation for socio-economically disadvantaged students— students working additional jobs or those from less affluent families. Furthermore, a new divide in access to virtual internships has emerged between rural and non-rural students.[1]

4.2. Research question 2: Associations between internship program quality profiles, marginalized identities, and internship modalities

4.2.1. Latent internship profiles by program characteristics and internship modality

To understand how marginalized virtual interns perceive work experiences once they get into the internship door compared to in-person, intern profiles are analyzed using 11 work design indicators reflecting perceived work experiences. Supplementary Table A4 details the fit indices for each LPA model, with the seven-cluster model as superior in goodness of fit, marked by lower BIC and L^2 and statistically significant LMR with increasing clusters, alongside entropy values above 0.9 indicating low classification error. Despite the marginal gains in L^2 reductions beyond four profiles, a five-profile solution was selected, primarily for its stronger alignment with structural working conditions. It better captured experiential variations linked to program structures like the year-long, paid programs documented for undergraduate interns (e.g., Downs et al., 2024). Additionally, this model includes a relatively acceptable sample size per cluster as well as a large total sample size.

For graphical illustration, mean values are standardized ($M = 0$, $SD = 1$) to distinguish between profiles based on task characteristics, supervisory support and style, and contextual working conditions (model indicators on the x-axis; see Supplementary Table A5 for unstandardized values). Each profile is labeled with descriptors summarizing different response patterns to be indicators. Fig. 2 delineates two immediately noticeable groups: those with above-average and below-average profiles in terms of task and supervisory support aspects. The upper segment of Fig. 2 identifies a segment comprising three professional intern profiles (Profiles 1–3), covering

[1] To correct for differential response probabilities arising from the low response rate and an over-representation of women in the sample, post-stratification weights calibrated to each institution's gender distribution were applied. The resulting weighted multinomial-logit estimates (see the "weighted" columns of Table A.3) mirror the unweighted results in both direction and magnitude for nearly every covariate; the one difference is that the positive rural-background association for the in-person-versus-no-internship contrast gains statistical significance after weighting ($p < 0.05$).

82.37 % of interns, indicative of quality educational programs with varying contextual working conditions. They typically experienced highly structured programs to learn about work, honing soft skills, and performing academically relevant tasks with clear goals. They also reported feeling professionally, socially, and emotionally supported by site supervisors. Variation among these profiles primarily reflects differences in contextual working conditions and collegiate advising. Interns in Profile 3, Professional Internships with Challenging Working Conditions (PICWC) (33.67 %), for example, generally engage in internships characterized by challenging working conditions—nearly unpaid, short-term, and part-time roles with limited college-provided guidance. This contrasts with Profile 1, Professional Internship with Favorable Working Conditions (PIFWC) (42.1 %), characterized by short-term, paid positions with high weekly workloads and limited academic advising support, and Profile 2, Year-long Professional Internship with Favorable Working Conditions (Year-long PIFWC) (6.6 %), which offers year-long, paid engagement with moderate weekly hours.

The remaining two subgroups in Fig. 2, constituting 10.28 % (Profile 4, Self-directed Internship with Favorable Working Conditions (SIFWC)) and 7.35 % (Profile 5, Self-directed Internship with Challenging Working Conditions (SICWC)) of interns, reported predominantly self-guided learning experiences within the internship ecosystem. These interns often faced ambiguous goals with restricted autonomy, a stark departure from the experiences of their counterparts in professional internship groups (i.e., Profiles 1–3). Their programs were characterized by limited opportunities for soft skill development, tasks loosely connected to their academic studies, and moderate supervisory support for task performance, well-being, and professional networking, despite these being integral components for professional and academic development. At least, interns in Profile 4 SIFWC learn in relatively favorable contextual working conditions, featuring dedicated time for work-based learning paired with financial compensation. However, this was not the case for interns in Profile 5 SICWC (7.35 %). They generally engaged in uncompensated, part-time roles with scarce chances for professional networking, conditions that make it challenging to facilitate meaningful learning experiences.

Additionally, an analysis was conducted on the characteristics of virtual interns' perceived program quality profiles and their distribution across each profile. Among the virtual interns, 80.28 % rated their programs as educationally structured and supportive (PIFWC, Year-long PIFWC, and PICWC); 55.71 % reported having a supportive remote work environment (PIFWC, Year-long PIFWC, and SIFWC); and 45.54 % worked in programs integrating clear goals, fair compensation, and relationship-building, whether short-term (PIFWC) or nearly year-long (Year-long PIFWC). However, 9.5 % were involved in low-quality, self-directed programs with challenging conditions (SICWC). Chi-square test of independence and post-hoc pairwise comparisons reveal that, compared to in-person interns, virtual interns were significantly underrepresented in Year-long PIFWC (4.77 % vs. 8.38 %) yet overrepresented in SICWC (9.5 % vs. 5.24 %) at the 0.001 level.

4.2.2. Joint associations of internship modality and marginalized identities with internship profiles

This section analyzes how students' marginalized identities and internship modality predict their likelihood of experiencing different internship quality profiles, holding other factors constant. The focus is on whether the gap between students with marginalized identities and their peers in learning in higher-quality versus lower-quality programs is attenuated or exacerbated in virtual settings compared to traditional in-person internships. Table 3 presents the log odds from multinomial logistic regression analyses. A positive log-odds ratio indicates interns in the focal group are significantly more likely to be in the focus profile compared to the reference group (PIFWC), which is characterized by meaningful tasks and strong supervisory, and structural support. Significant interaction coefficients between virtual modality and marginalized identity status indicate that the relationship between marginalized

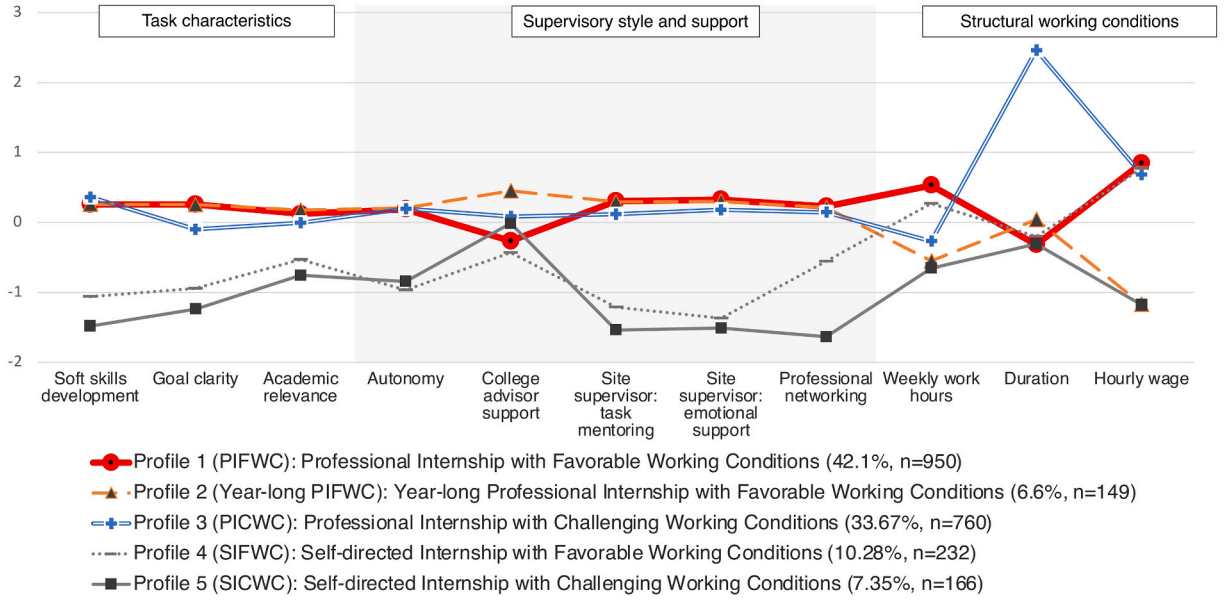

Fig. 2. Standardized means of five latent internship profiles.

Table 3
Multinomial logistic regression estimates of marginalized identity indicators on latent profile membership.

	Year-long PIFWC vs PIFWC	PICWC vs PIFWC	SIFWC vs PIFWC	SICWC vs PIFWC
Virtual	−.52 (.58)	.36 (.37)	.17 (.42)	1.32 (.7)
Asian	.47 (.42)	.53 (.30)	.64 (.38)	1.22* (.5)
Black or Hispanic	.51 (.39)	.12 (.28)	−.44 (.51)	.16 (.55)
Other race/ethnicity	.28 (.42)	.21 (.29)	−.68 (.55)	.15 (.57)
Women	.06 (.24)	.85*** (.18)	−.25 (.22)	1.1** (.39)
Rural background	.04 (.24)	−.27 (.16)	.13 (.22)	−.22 (.31)
Middle income	.16 (.35)	.27 (.25)	−.05 (.29)	.02 (.45)
Lower income	.13 (.41)	.64* (.27)	.03 (.35)	−.05 (.5)
Unknown income	.25 (.44)	.45 (.30)	.12 (.38)	−.18 (.59)
Weekly work hours >20	−.65 (.36)	.58** (.21)	−.03 (.32)	1.29** (.43)
Weekly work hours ≤20	−.04 (.25)	.26 (.18)	.30 (.24)	1.03** (.39)
Virtual × Asian	−.63 (.64)	−.12 (.37)	−.50 (.49)	−.73 (.59)
Virtual × Black or Hispanic	−.35 (.58)	−.59 (.38)	−.16 (.67)	−.68 (.68)
Virtual × other race/ethnicity	.54 (.65)	−.48 (.44)	1.61* (.65)	−.54 (.78)
Virtual ×women	.82 (.44)	−.04 (.25)	.03 (.31)	−.25 (.48)
Virtual × rural background	−.21 (.41)	−.18 (.23)	−.16 (.32)	.11 (.40)
Virtual × middle income	−.04 (.54)	.25 (.34)	−.08 (.41)	.35 (.59)
Virtual × lower income	−.36 (.62)	−.19 (.37)	−.12 (.47)	.76 (.63)
Virtual × income unknown	−1.10 (.76)	−.12 (.41)	−.70 (.55)	.61 (.73)
Virtual × work hours >20	.81 (.58)	.76* (.32)	.57 (.48)	−.08 (.55)
Virtual × work hours ≤20	−.7 (.43)	.11 (.25)	−.06 (.34)	−.97* (.48)
Pseudo R^2	.09			

Note. $N = 2{,}132$, ***$p < 0.001$, **$p < 0.01$, *$p < 0.05$.
PIFWC = Professional Internship with Favorable Working Conditions (Profile 1); PICWC = Professional Internship with Challenging Working Conditions; SIFWC = Self-directed Internship with Favorable Working Conditions; SICWC = Self-directed Internship with Challenging Working Conditions. Standard errors are presented in parentheses. Full model specifications and internship-mode-specific coefficients are available in Table A.6 and A.7, respectively, in the online supplementary materials.

identity and profile membership differs for virtual versus in-person interns, suggesting that virtual learning environments may either attenuate or exacerbate existing gaps.

Analysis of the interaction terms in Table 3 reveals no significant differences in the likelihood of historically underrepresented students or their peers in virtual versus in-person modalities experiencing year-long PIFWC compared to short-term PIFWC (i.e., 13.3 weeks). In other words, when it comes to similarly pedagogical and resource-rich internships, whether year-long or short-term, there is

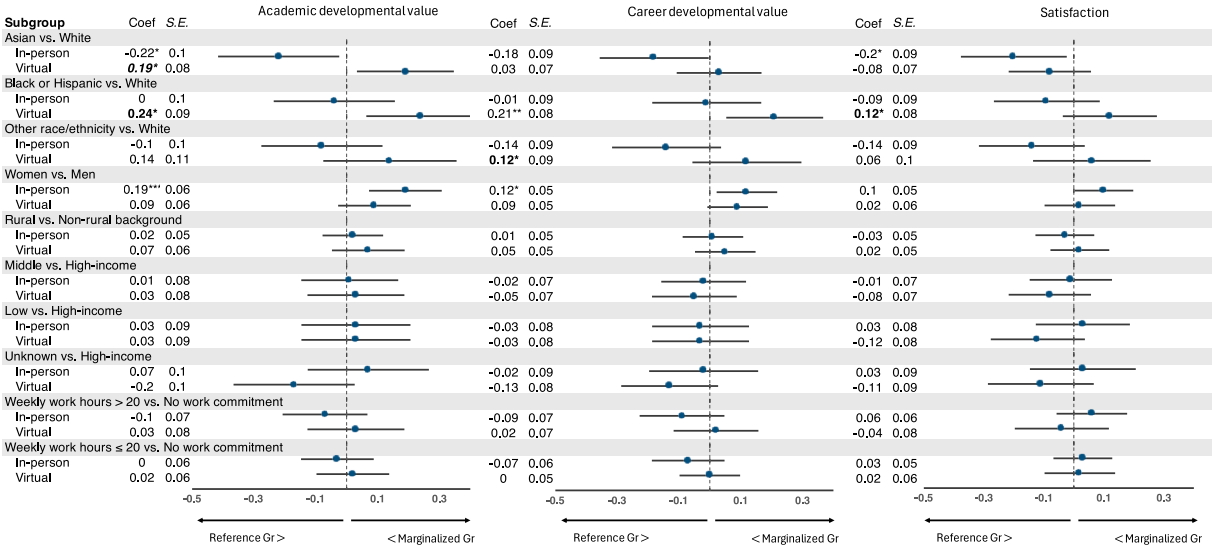

Fig. 3. Forest plot of internship outcome differences by student group and internship modality
Note. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$. The point represents the point estimate of the difference in the outcomes between each corresponding subgroup and the reference group in each internship modality and the horizontal lines are the 95 % confidence intervals. Statistical significance of the mean difference in outcomes between virtual and in-person modes within each subgroup (interaction effects) are included (0.05 in **bold** and 0.001 in ***italics***). For detailed interaction effects between internship modality and subgroups, see Online Supplementary Material Table A.10. The dotted line represents no significant difference in outcomes between in-person and virtual interns, regardless of the group.

no evidence that gaps in the likelihood of experiencing quality learning opportunities between historically underrepresented students and their peers are either reduced or widened in virtual settings.

However, a distinct pattern emerges: across modalities, marginalized interns are more likely than their privileged peers to be placed in compromised profiles—PICWC (strong education and supervision, poor conditions) or SIFWC (favorable conditions, weak education and moderate support)—rather than the comprehensively supportive PIFWC; moreover, this disparity is significantly larger in virtual settings than in in-person internships. For example, Table 3 shows that the gap in the likelihood of learning in PICWC versus PIFWC is significantly greater ($\beta = 0.76$, $p < 0.05$) between virtual interns who have other work exceeding 20 h a week and in-person counterparts, compared to students with no other work commitments. Supplementary Table A7, under PICWC vs PIFWC, further demonstrates that while these gaps exist in traditional in-person internship settings ($\beta = 0.54$, $p < 0.05$), they are substantially magnified in virtual environments ($\beta = 1.35$, $p < 0.001$). Similarly, under SIFWC vs PIFWC, reveals emerging gaps for students from other racial and ethnic groups in virtual settings ($\beta = 0.94$, $p < 0.01$) regarding their likelihood of experiencing SIFWC, self-directed yet operationally sound programs, versus PIFWC, as no significant other race-white differences were found in traditional in-person settings ($\beta = -0.66$, $p > 0.05$). Table 3 shows such racial difference across internship modalities is statistically significant ($\beta = 1.61$, $p < 0.05$).

Conversely, interns working fewer than 20 h per week in non-internship jobs show reduced gaps between virtual and in-person modes ($\beta = -0.97$, $p < 0.05$; see Table 3), compared to those without employment commitments. This pattern is observed when examining participation in programs at opposite ends of the quality spectrum—SICWC, a self-guided internship with challenging work conditions representing low-quality programs, and PIFWC, a better-resourced program representing high-quality internships. Further examination in Table A.7 reveals that while interns with limited concurrent employment show a significantly higher likelihood of experiencing challenging working conditions with limited educational support in in-person settings relative to peers without outside work commitments ($\beta = 1.04$, $p < 0.01$), this gap becomes negligible in virtual environments ($\beta = 0.04$, $p > 0.05$).

4.3. Research question 3: Joint associations of internship modality and marginalized identities with internship outcomes

The last analysis explores how internship outcomes vary between marginalized and non-marginalized students across different internship modalities. Fig. 3's forest plot illustrates these results from separate OLS regressions for each modality (see Online Supplementary Tables A8 and A.9 for details) along with interaction effects (see Online Supplementary Table A10). Each row illustrates how a subgroup's outcome compares with the reference group in both in-person and virtual internships shown by point estimates and dots. If the dot lies to the right of zero, the corresponding subgroup's average outcome is higher; if to the left, it's lower. Comparing the virtual dot to the in-person dot within the same panel shows whether the gap narrows (virtual dot shifts right) or widens (virtual dot shifts left). Statistical significance of any subgroup difference between in-person and virtual outcomes (i.e., interaction effects) is noted in bold for $p < 0.05$ and in bold italics for $p < 0.001$.

One overarching pattern is that marginalized students generally report higher outcomes in virtual settings, whereas non-marginalized students tend to rate their outcomes more favorably in traditional in-person settings, even after accounting for quality profiles and student backgrounds. When assessing how in-person internships are associated with academic knowledge enhancement and satisfaction, White interns tend to rate them significantly more favorably than Asian peers ($\beta = -0.22$, $p < 0.05$; $\beta = -0.2$, $p < 0.05$). Conversely, Asian interns are likely to rate academic developmental values from virtual internships higher than White peers ($\beta = 0.19$, $p < 0.05$). Furthermore, such modality-based differences in academic outcomes for Asian versus White interns are statistically significant ($\beta = 0.41$, $p < 0.001$), suggesting under virtual settings, the gap in academic developmental values for Asian interns narrows compared to in-person settings. For Black or Hispanic interns, although their outcomes were comparable to those of White peers in in-person settings, they tend to report a higher academic ($\beta = 0.24$, $p < 0.05$), career developmental value ($\beta = 0.21$, $p < 0.01$) as well as satisfaction ($\beta = 0.12$, $p < 0.05$) than White interns in virtual settings. Moreover, these modality-based differences were significant for both academic developmental value ($\beta = 0.3$, $p < 0.05$) and satisfaction ($\beta = 0.25$, $p < 0.05$). Similarly, interns of other racial and ethnic backgrounds tend to report more favorable career developmental outcomes ($\beta = 0.12$, $p < 0.01$) than White interns in virtual settings, and modality-based gaps are statistically significant ($\beta = 0.27$, $p < 0.05$). In contrast, the results did not show evidence of significant modality-based differences in outcomes among other marginalized subgroups. Together, these findings suggest that, even among interns with similar backgrounds and program quality, racially marginalized students benefit more from virtual internships, highlighting this modality's potential to mitigate racial disparities in outcomes.

5. Discussion

This study represents one of the first holistic examinations of virtual internship experiences across access, learning quality, and developmental outcomes, with a focus on historically marginalized students. An analysis of survey data from 11,009 U.S. undergraduates across 17 institutions reveals a duality for virtual internships, offering clear mobilizing potential for some historically marginalized students while simultaneously reinforcing systemic barriers for others.

5.1. Mobilizing potential of virtual internships

Empirically, this study offers new evidence that virtual internships can serve as an equalizer, particularly for racially and ethnically marginalized students. Participation gaps for Asian, Black, or Hispanic were narrower in virtual settings compared to in-person ones. Notably, these access gains translate into smaller racial gaps in satisfaction, perceived academic outcomes, and career outcomes within virtual internships. These findings are largely aligned with Fletcher et al. (2023), who reported high satisfaction rates among

predominantly Latinx and Black high school students participating in virtual programs.

Several mechanisms may explain these shifts. One plausible mechanism is that enhanced flexibility and removal of logistical barriers including commuting and relocation likely expanded access, particularly benefiting students of color who face these challenges more often (The White House, 2021). Another plausible mechanism may be that virtual formats reduce interpersonal stressors commonly experienced in traditional face-to-face professional settings. This pattern appears in findings suggesting that Black engineers working remotely report fewer microaggressions and less pressure to code-switch (Nicholson et al., 2022), while hybrid professionals from Asian and Black backgrounds seem to encounter fewer discriminatory experiences remotely (Vinluan & Kraus, 2025). By potentially alleviating these social and psychological burdens, virtual environments might have enabled more authentic engagement during recruitment and could have enhanced learning from work-based opportunities (NACE, 2021).

These equalizing effects extend to students balancing moderate employment alongside their studies. Although they face elevated risks of accepting lower-quality internships in in-person formats—potentially due to competing work commitments—this disadvantage largely disappears in virtual environments. This could occur if the inherent flexibility of remote internships dismantles the rigid scheduling and geographical constraints that would otherwise limit their options, potentially enabling these students to pursue high-quality opportunities across broader geographic regions while maintaining greater selectivity than local, in-person alternatives would typically allow.

5.2. Limited mobility and reinforced disparities

Meanwhile, this investigation confirms that virtual internships may sustain and even widen disparities for other vulnerable groups. Students from racial and ethnic minorities, and those working long hours, are disproportionately routed into placements with exploitative conditions or minimal pedagogical support. For rural students, virtual internships remain much less accessible than in-person ones. This pattern echoes long-standing concerns about socio-technical barriers: rural households are less likely to have reliable broadband (Pew Research Center, 2021), and sparse local networks and institutional supports further limit access to virtual opportunities even with infrastructure in place (Jenkins et al., 2023).

In contexts where disparities do not widen, women and middle-income students remain concentrated in internships with weak developmental design across both virtual and in-person formats (Carnevale & Smith, 2018; Gracia, 2009; Hora, Wolfgram, Chen, et al., 2022). Middle-income students still face systemic access barriers, while women are more likely to receive lower-quality placements. Students working extensive hours are hit hardest in their entry, plus while interning. When they take the rare opportunities, they tend to confront a double bind of low-wage part-time positions with minimal supervisory support and limited learning-oriented opportunities—or often, both, which are unlikely to be a significant upgrade from the roles held by their non-working peers or current side jobs. This creates a troubling paradox where heavily working students invest substantial resources and time in internships, hoping to gain structured, field-specific experiences and future career benefits beyond their current roles (Stasz & Brewer, 1998), only to find themselves in positions that mirror the very challenges they sought to address.

While this study cannot pinpoint the exact mechanisms, these reinforcing dynamics might have stemmed from interconnected dynamics operating at both student and employer levels. From the student perspective, although remote formats offer scheduling flexibility, they cannot eliminate the profound time scarcity and financial pressures faced by students juggling coursework, caregiving, and paid employment. Consequently, these students may feel compelled to accept "less desirable" (Frenette et al., 2021, p. 17) part-time or unstructured remote roles, prioritizing immediate flexibility over richer developmental quality. The widespread view of internships as essential for employment could amplify this dynamic, potentially generating scarcity pressure (Hora et al., 2020) that systematically drives underserved students—including women already concentrated in precarious roles (Shade & Jacobson, 2015)—into the poorest-quality opportunities.

Turning to the employer side, these dynamics may intersect with institutional sorting patterns. Despite technological accessibility and open recruitment, established hierarchies may persist where elite firms prioritize candidates from selective universities using social class markers (Rivera, 2016). Consequently, high-quality remote internships from well-resourced hosts likely remain channeled through exclusive pathways accessible primarily among privileged students. Conversely, resource-constrained organizations, such as small firms, startups, and non-profits, often leverage remote formats for efficiency and lower-cost talent access, resulting in internships that may be unpaid, unstructured, or poorly supervised (Jeske & Axtell, 2016). These positions may attract students outside elite recruitment pipelines and those requiring flexibility, including women and those working long hours, even though these organizations may show the same interest in the privileged candidate pool. This stratification of opportunity closely mirrors gig economy dynamics (Wood et al., 2019), where flexibility promise often masks poor working conditions and diminished job quality for those with limited bargaining power. Future research will help us understand in more detail what drives variation in virtual internship experiences across different student populations.

5.3. Theoretical and methodological contributions

Altogether, this study makes theoretical contributions to work-based learning scholarship. Above all, it refines the "internship divide" concept (Frenette et al., 2015) by revealing how structural inequality manifests across multiple layers of the internship experience—not only access but also learning quality and outcomes. The nature of this divide varies by modality and student subgroups, building on prior work documenting access disparities in onsite internships (Hora, Wolfgram, Huerta, et al., 2022) to reframe how equity is understood in virtual internships and work-based learning contexts.

This refinement informs a second theoretical contribution: the development of a multidimensional typology of internship learning

quality. This typology serves as a conceptual framework that clarifies the structure and variation within learning experiences, enabling the identification of patterns and disparities that would remain hidden in simpler categorizations. At first glance, the internship typology supports the parity assumption in learning quality, as virtual and onsite interns participate in educationally structured programs (i.e., PIFWC, PICWC, or SIFWC) at nearly similar rates (85.68 % versus 86.39 %), suggesting comparable learning experiences for most participants. However, this equivalence premise does not hold at the extremes of quality distributions, though they comprise only 14.27 % of the sample. Virtual internships show overrepresentation in under-resourced, unstructured experiences (9.5 % versus 5.24 % for SICWC) and underrepresentation in long-term, high-quality placements (4.77 % versus 8.38 % for yearlong PIFWC). These patterns extend scholarship documenting poor internship quality in traditional settings (Perlin, 2012; Rogers et al., 2021) by revealing that similar quality concerns manifest distinctively in virtual formats. That said, these findings should not lead to wholesale rejection of virtual internships without a nuanced understanding of their role for students who might otherwise lack access to such opportunities under different scenarios. Rather, this study provides a baseline for future research and policy, pinpointing where virtual internships warrant strengthening to serve as an alternative academic-to-career pipeline.

Methodologically, this research develops an integrated framework for quantifying the refined internship divide (Frenette et al., 2015) through simultaneous examination of the full internship pipeline from access through outcomes while capturing interactive learning dimensions across modalities based on latent profile analysis. While the current approach may not fully capture affordances and constraints of virtual internships, the framework may serve as an initial research-informed tool for stakeholders to systematically monitor and support when, where, and for whom virtual internships serve as viable and equitable alternatives.

5.4. Limitations and future directions

Nevertheless, several limitations should be acknowledged. First, the low response rate (4.53 %) and the overrepresentation of women in the respondent sample (69.62 %) raise concerns about generalizability and the potential for non-response bias. While post-stratification weighting based on institutional gender distributions helped mitigate bias in access analysis, the lack of reliable demographic data specific to the intern population limited similar adjustments within the intern subsample. Therefore, caution is warranted when interpreting and generalizing these results. Future research should employ strategies to improve response rates, incorporate more complete administrative records, and examine these patterns with larger, more representative samples in post-pandemic contexts to better assess generalizability.

Second, beyond generalizability, the study's cross-sectional design limits causal inference. Without longitudinal data or a non-participant comparison group, this study cannot assess the causal impact of virtual internships relative to in-person options—or to no internship at all. Although available student characteristics were controlled to partially mitigate baseline differences, discrepancies in access, quality, and outcomes may result from unobserved factors (e.g., individual motivation). Future research employing randomized controlled trials or quasi-experimental designs with longitudinal panel data would mitigate these limitations by reducing selection bias. Combined with direct career and academic outcomes, such studies would provide stronger evidence of whether virtual internships genuinely expand access and improve outcomes.

Third, the findings must be situated in their unique temporal context. This study is based on student responses during the pandemic, a period when the abrupt shift to remote work likely introduced inconsistencies in program design. Additionally, broader trends—such as return-to-office mandates (Pringle, 2024) and the growing use of artificial intelligence in recruitment (Harter & Wigert, 2025)—are reshaping the internship landscape. Findings should therefore be interpreted as a snapshot of a unique moment in time.

Finally, these findings point to the importance of examining how employers perceive and value virtual internship experiences in future studies. Some employers view remote formats as opportunities to diversity talent pipelines (Kraft et al., 2019) and expressed satisfaction with virtual interns (Park & Jones, 2021), while others remain ambivalent, comfortable evaluating performance but hesitant to hire based on remote experience alone (Naqvi, 2024). This reluctance suggests the most accessible internship options risk being devalued in the labor market, offering a diminished professional payoff that could disproportionately affect marginalized students. Therefore, understanding how employer perceptions translate into hiring decisions across sectors represents a critical avenue for future research to ensure that virtual internships fulfill their equity potential.

6. Conclusion

As labor markets stabilize into a post-pandemic new normal—nearly two-thirds of employers anticipate maintaining hybrid schedules even as fully remote work declines (NACE, 2025)—internships remain a pivotal bridge from campus to career. Results from the present analysis underscore both the promise and the continuing challenges of the virtual turn for marginalized students. Taken together, these patterns highlight opportunities for educators, employers, and policymakers to move beyond a "technology-will-solve-it" stance and invest in deliberately designed, well-resourced internship models if the equity potential of hybrid and virtual work is to be realized.

Three strategic levers may warrant closer consideration by institutions and policymakers. First and foremost, to counteract the finding that students with extensive work commitments are funneled into lower-quality roles, institutions might consider supporting students through needs-based stipends, tuition-free credit, or wage subsidies. Credit-bearing options, in particular, could reduce the opportunity costs associated with balancing academic and work responsibilities.

Additionally, institutions might consider thoughtfully structured hybrid internships that blend remote flexibility with intensive in-person engagement, leveraging intentional design elements such as structured mentoring, project-based learning, and alumni networking and peer interaction to maximize benefits. Short in-person residencies centered on mentorship and collaborative work can

help reclaim developmental benefits often diluted in fully virtual roles. These formats may be especially impactful for students managing caregiving responsibilities, limited transportation, or rural connectivity gaps. Additional supports such as travel stipends, broadband subsidies, or shared co-working hubs can further reduce participation barriers (Hruska et al., 2022). Hybrid designs may prove especially valuable for women in STEM, who report stronger confidence and professional identity following virtual internships with individualized mentoring (Arastoopour et al., 2014), despite being disproportionately placed in lower-support environments across both modalities.

Realizing these opportunities will require more robust data and feedback systems (Frenette et al., 2021). Institutions might build on the profile-based monitoring framework introduced in this study to track from access through internship quality and outcomes, similar to the bi-weekly communication system between interns and college advisors described by Jenkins et al. (2023). Advising professionals can use these tools to guide students toward high-support placements and identify internships in need of redesign. Employers and universities might also collaborate to deliver brief supervisor trainings focused on inclusive mentoring and virtual engagement, introducing workshops focused on digital communication skills, time management, or relationship-building opportunities for virtual interns (Perusso & Wagenaar, 2024). Such partnerships could also co-develop improvement cycles for internships flagged as low-profile internships in order to foster a culture of continuous improvement. Through these thoughtful redesigns, virtual internships can move closer to serving as equitable pathways that connect diverse talent to quality learning opportunities while supporting students' professional aspirations across the full spectrum of backgrounds and circumstances.

Declaration of competing interest

The authors have no conflict of interest to declare.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.compedu.2025.105439.

Data availability

The data that has been used is confidential.

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