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Structural Concerns in Minority Serving Institutions Delivering Online Architecture, Engineering, and Construction Education

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Minority Serving Institutions (MSI) aim to bring equity to education and support the development of a diverse workforce to address numerous challenges. COVID-19 significantly impacted academia and institutions, including MSI. This research focused on how AEC educators affiliated with MSI were impacted by Online Learning Environment (OLE) proficiency and technology associated with COVID-19 impacts. To determine how educators were affected, an electronic survey was sent to universities within the US. The survey was sent to two population sets of Construction educators and Architecture and Engineering educators, about six months apart. The survey queried AEC educators about their teaching experience, teaching load, proficiency in online content delivery, university policies, concerns over the online delivery of courses, and ability to deliver AEC education online. To determine differences between MSI and non-MSI respondents, the over 400 responses from the survey were compared with the 800 institutions classified as MSI. Quantitative analyses were performed on multiple choice questions, and qualitative analyses were performed on open-ended questions to identify the top three education concerns. Research previously determined concerns for delivering all online courses, like a lack of faculty-peer interaction and peer-to-peer interaction, and structural university-level concerns, but not from the MSI perspective which is required.

Key Words: Minority Serving Institutions; Minority Participation in Construction, MSI Faculty Expertise, EC Education

Introduction

There are over 800 identified Minority Serving Institutions (MSI) in the US (NASA 2023) to alleviate impacts of inequalities across race and ethnicity for higher education (USDA n.d.) and include Asian

American Native American Pacific Islander Serving Institutions (AANAPISIs), Historically Black Colleges and Universities (HBCUs), Hispanic Serving Institutions (HSIs), Tribal College and Universities (TCUs) (Harmon 2012). MSI supports and serves the educational needs of minority and low-income students and supports first-generation students in attaining education (ACE 2019). In 2021, about 15.4 million undergraduate students were enrolled in MSIs nationwide, which is projected to increase to 16.8 million by 2031, an increase of 9% (NECS 2023). Thus, MSIs are an integral part of the education ecosystem that helps and supports minority and underprivileged students attain education, prosper economically, and contribute to the nation's growth.

The COVID-19 pandemic impacted the educational ecosystem significantly (Langar et al. 2022; USOCR 2021), and the problem was severe for MSIs (USOCR 2021). Previous publications have broadly identified challenges to Architecture, Engineering, and Construction (AEC) online education delivery (Adhikari et al. 2021, Asgari et al. 2021), differences observed in MSI should be identified as an obvious focus for improvement. Research is also necessitated by the negative pandemic impact on academic outcomes for students, widening learning gaps, and reduced enrollments (USOCR 2021). In addition, there is limited research on organization and educational delivery in MSIs (NASEM 2019). Given the need, the research determined how AEC educators affiliated with MSI were impacted in the areas of proficiency in OLE and technology as compared to their peers from non-MSIs with the impacts of COVID-19. The research also tested two hypotheses: *H1: Faculty responses in MSI may be inherently different than faculty in non-MSI, as research indicates minorities have access to educators in schools with limited experience (USOCR 2021).* Therefore, the researchers also wanted to test whether this was true for MSIs. *H2: MSI infrastructure would be a faculty concern, especially online delivery infrastructure, as technology was identified as one of the significant barriers to OLE.* Therefore, the research tested if technology was a concern among educators within an MSI.

Literature Review

There are various concerns about delivering all online courses, such as lack of faculty-peer interaction and peer-to-peer interaction (Mosier et al. 2023, Sulbaran et al. Forthcoming). Similar concerns were found to be prevalent among minority students nationwide, who indicated the Online Learning Environment (OLE) experiences are worse than in-person experiences (AIHEC 2021). Some specific areas the TCU respondents identified as worse than in-person experiences included the ability to understand materials, ask questions, interact with instructors, learn from peers, interact with peers, and others (AIHEC 2021). Some of these factors can be tied to the teaching pedagogies that educators could implement and others to student perceptions about the online educational delivery in OLE. Other faculty challenges included the lack of software license, reliable internet/remote connection, no printer/scanner, no webcam/camera, no microphone/headset, and no computer/tablet (Asgari et al. 2021). These concerns may indicate a lack of university, college, or department-level funding. At the same time, all universities may be subject to reduced federal funding, dependent on the ever-evolving federal government. These changes can affect federally funded minority-specific support programs such as TRIO, which supports university tutoring and retention programs (Domonell 2013), when there are reductions to income-based financial aid, students and institutions relying on this aid type suffer. The effect of reduced funding can differ between institutions due to state-level input into the distribution of certain types of funds. State subsidies for universities have fallen over time, one of the methods to recoup the losses is fee-based, with engineering degrees having some of the highest fees), which may cause students to seek less expensive alternatives (Stange 2015). The problem for MSIs (including HBCUs and TCU) is exacerbated by reliance on student tuition and the post-pandemic enrollment decline economic impact (USOCR 2021), and the ability to serve the students and communities.

There is an identified gap in the number of minority students entering college (Libassi 2018), and there is also a difference in university degree attainment and continuing into advanced degrees in science and engineering (NSF 2019). Comparing the total population, 42% identify as minorities, while the college graduation rate is closer to 38% (NSF 2019). With the over 800 institutions MSI classified (NASA 2023), it could be assumed there is support for minorities within the US system. Literature points to minority students K-12 impediments, including a lack of teacher expertise and social isolation (Garcia et al. 2019), exacerbated by online course delivery during the pandemic (AIHEC 2021). As students move through their college careers, many programs focus on identity which is purposefully created through courses, advising (Han et al. 2021), and living-learning communities (Ciston et al. 2011). Minority students do better with minority faculty (Berrett 2011), which indicates a diverse faculty is necessary for success. When considering there is a reduced rate of minorities entering advanced degrees, it may be expected there would be a similar reduction in minorities entering academia. About 0.22% of civil engineering faculty identify as Native American (Nelson 2018). A consideration is 8.2% of US engineering faculty are native-born Latino/Latinx, with 20.3% of civil engineering faculty being Latino/Latinx without regard to country of origin.

Given the background and challenges faced by MSI, the research aimed to identify how AEC educators from MSI and non-MSI perceived the COVID-19 impacts in OLE and technology proficiency. A closer look at MSI was taken by comparing faculty responses based on their associations with MSI and non-MSI. The initial survey was focused on faculty AEC education online delivery concerns, with respondents representing MSI. Two hypotheses (identified earlier) were developed based on the recent literature, and their applicability to MSIAEC programs was determined. One hypothesis was developed that states faculty responses in MSI may be inherently different than faculty working in non-MSI. The second hypothesis stated MSI infrastructure would be a faculty concern due to MSI limitations, especially infrastructure as identified in the literature (USOCR 2021). The hypotheses are supported by differences found in previous studies (Asgari et al. 2021, Sulbaran et al. Forthcoming).

Methodology

Construction educators and Architecture and Engineering educators, to determine AEC faculty concerns with the sudden transition to OLE in response to COVID-19. The online survey queried AEC educators about years of teaching experience, teaching load, proficiency in online content delivery, university policies, concerns over the online delivery of courses, and whether AEC education could be delivered all online. Information about AEC educators was obtained from publicly available websites and listservs. The national AEC educator surveys generated about 407 responses in total. The compiled responses were sorted into MSI and non-MSI responses as the respondents indicated the institution names. Quantitative and qualitative analyses were performed on the dataset. Further, qualitative analysis was performed using a computation framework (Sulbaran et al. Forthcoming). The research also tested the validity of the following two hypotheses:
H1: MSI faculty responses may would be inherently different than faculty at other institutions.
H2: MSI infrastructure would be a faculty concern, especially online delivery infrastructure.

Results/Discussion

The U.S. construction industry consists of construction managers who are over 80% white (DataUSA 2023). For MSI universities, there were 67.1% white respondents compared to 77.7% white at non-MSI universities, indicating a potential difference in faculty ethnicity. When considering the hypotheses presented, it is expected faculty at MSI should respond differently to questions posed

about experience and institutional support. About 17.2% of the responding educators were affiliated with an MSI, and the remaining 82.8% were affiliated with a non-MSI (Figure 1).

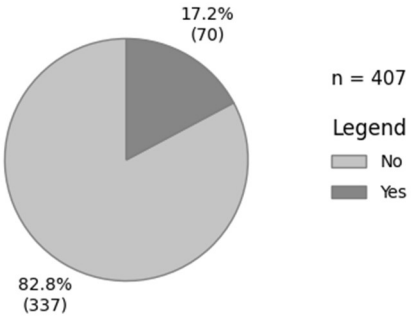

Figure 1. Respondents from Minority Serving Institutions

Research indicates MSI educators have limited university experience, while the findings (Figure 2) indicate some differences when comparing the teaching experience (years) between respondents affiliated with an MSI (Yes) and those not affiliated with an MSI (No). Only about 21.4% of respondents affiliated with an MSI had less than five years of teaching experience as compared to 12.2% for the same experience levels at a non-MSI university. It should also be noted the teaching experience curve peaked slightly at less than five years for educators affiliated with an MSI versus non-MSI institutions at less than ten years (Figure 2). This indicates non-MSIs had more experienced educators than MSIs. This is worth noting because most tenure-track assistant professors are required to submit their package for tenure and promotion at year 5. It is also interesting to note with the exception of more than 20 years', the percentage of respondents in MSI is lower than non-MSI.

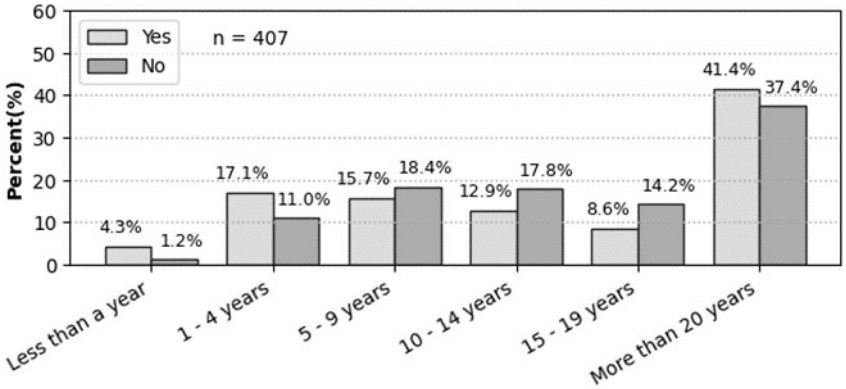

Figure 2. Years of Teaching Experience

Faculty retention can be connected to faculty workload (Griffith and Altinay 2020). Research indicates construction faculty teach 14 credit hours on average annually (Adhikari et al. 2021). Faculty loaded over 12 credit hours annually are working close to 55 hours per week, which may contribute to faculty retention concerns (Griffith and Altinay 2020). Educators typically have a reduced teaching load in the first few years. Teaching load curves are quite similar to the years of teaching experience (Figure 3).

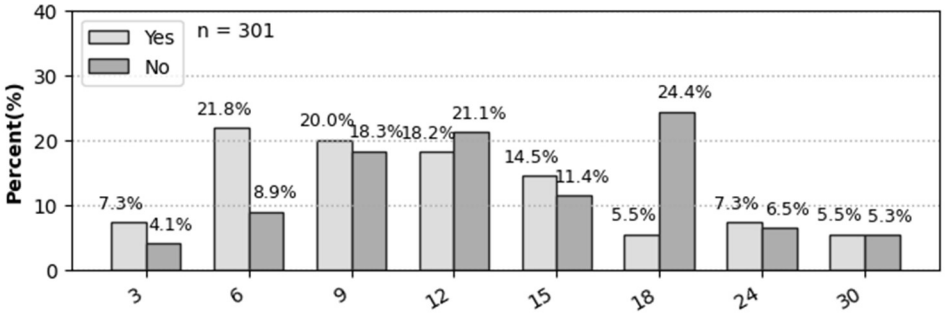

Figure 3. Teaching Load in Credit Hours

Regarding online content delivery proficiency, 17.1% of responding MSI educators had never interacted in OLE, compared to 21.1% of non-MSI educators before COVID-19. With 44.3% of responding MSI educators had a proficiency level of "Novice" or "Advanced Beginner" which is much higher than non-MSI respondents, where 34.7% represented the same category. Pre-Covid MSI educators indicated a higher proficiency in online content delivery than non-MSI. (Figure 4). Existing literature does suggest educator expertise can be a concern (Garcia et al. 2019).

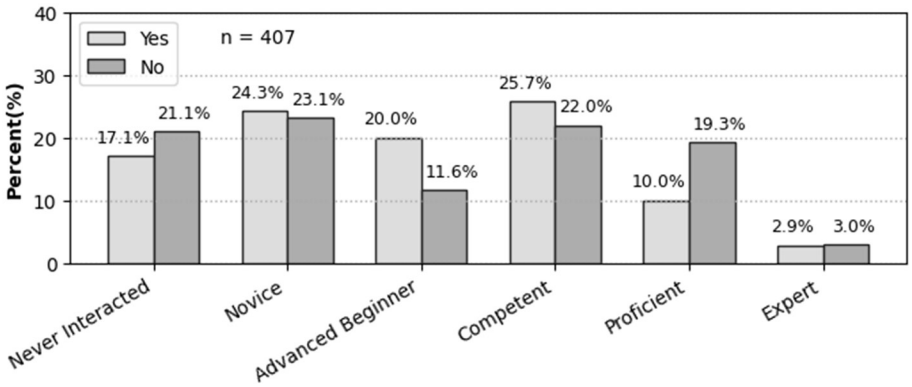

Figure 4. Proficiency In Online Content Delivery (Pre-Covid)

A structural difference in faculty might be apparent when considering the pre- and post-Covid results, with post-Covid proficiency rates are very similar between faculty at MSI and non-MSI (Figure 5).

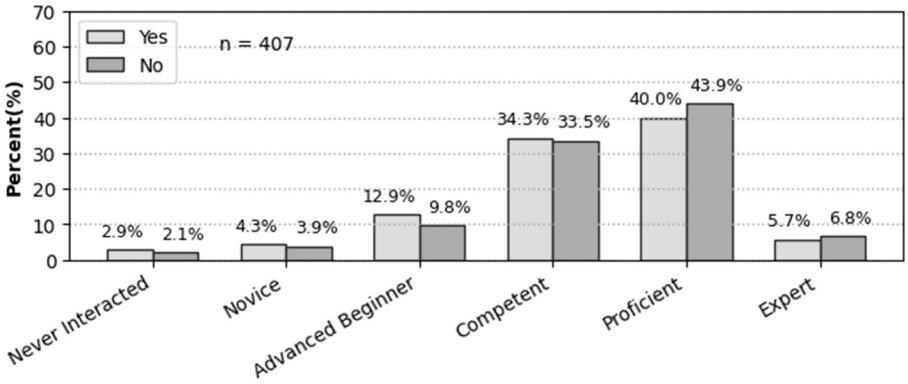

Figure 5. Proficiency In Online Content Delivery (Post-Covid)

Access to technology has been identified as a concern in the literature, and the research aimed to determine if there were any differences in technology requirements between an MSI or non-MSI educator perception. Access to technology was measured by departmental requirements to purchase laptops to access education, which was needed when the education suddenly transitioned due to COVID-19 requirements. MSIs had a higher technology requirement for students than non-MSI (Figure 6). MSI faculty appeared to have more knowledge/clarity about technology requirements than their non-MSI peers. Also, differences were observed at the university level, where there are fewer "yes" responses from MSI faculty than other faculty with more "no knowledge" responses than "yes." As a consideration of a structural concern, departmental or university requirements for students to purchase laptops are identified. There is little difference in MSI as compared to non-MSI. In fact, MSI faculty appear to be more familiar with the requirements (Figure 6).

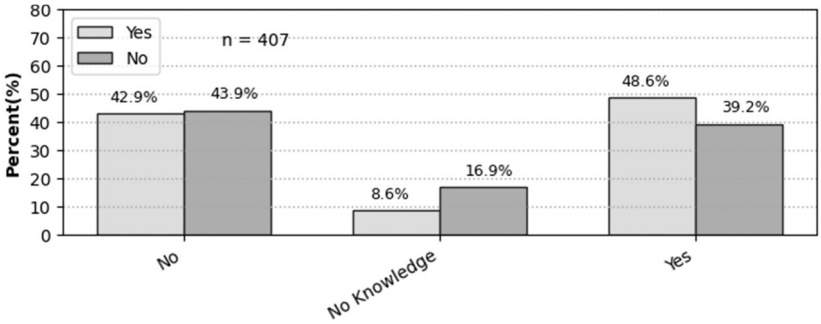

Figure 6. Departmental Requirement to Purchase Laptop

Over 75% of MSI educators acknowledged the university provided guidance on internet access (Figure 7). Educators indicated the level of support provided by the university during the COVID-19 transition based on a scale of 0 to 100. There is no noticeable trend in MSI educators as compared to non-MSI. Almost 49.1% of educators did know the university position about students without internet access.

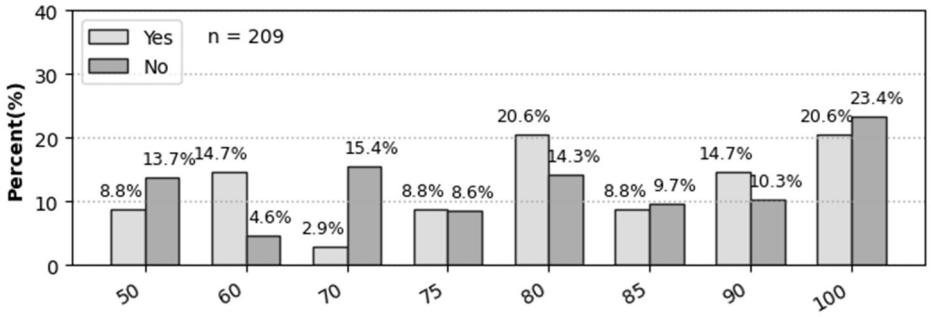

Figure 7. OLE University Level of Support

Responses were “stemmed” using Snowball Stemmer software to determine the stem or root word. These stemmed words are shown in Figures 8 & 9, where attention becomes “attent” and ability becomes “abil.” A comparison was made between MSI and non-MSI educators on their top three concerns about moving to all-online delivery. The difference in results between faculty groups is small (Figures 8 & 9). While "attention" and "communicate" are evident in the MSI faculty concerns, they are replaced with "engage" and "learn" for all other insitutions. Faculty at MSI institutions had similar perceptions about the ability for AEC education to be delivered all online with no significant difference.

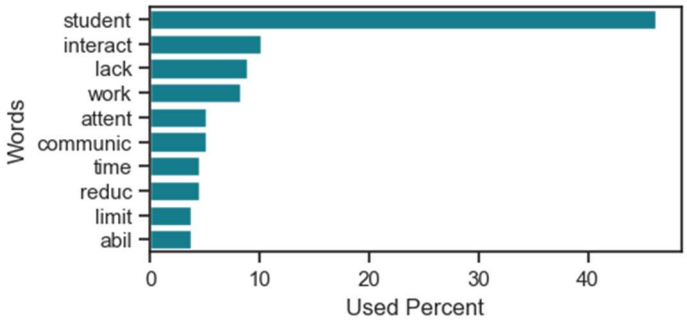

Figure 8. MSI Faculty Concerns with All Online Course Delivery

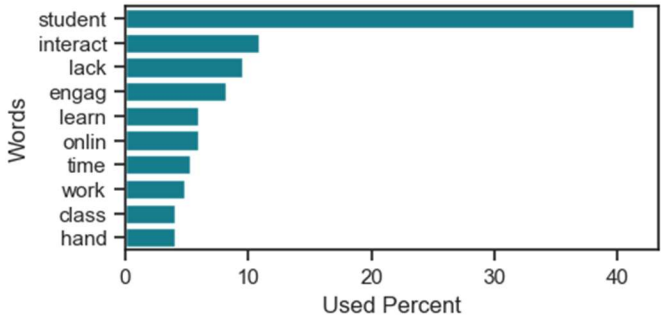

Figure 9. All Other Faculty Concerns with All Online Course Delivery

Conclusions

The study provides crucial insights into operations and challenges that AEC educators affiliated with MSIs encountered during the COVID-19 pandemic. By examining responses from AEC faculty, the research underscores the essential role of MSIs in advancing educational equity and bolstering support for minority and first-generation students in higher education. The findings regarding the hypotheses posited at the beginning of the research are mixed. The findings reveal a disparity (modest) in the extent of teaching experience between MSI and non-MSI faculty, with a slightly higher percentage of MSI faculty having fewer than five years of teaching experience. The findings are consistent with sources of literature (USOCR 2021). At the same time, AEC MSI educators exhibited significant proficiency improvements compared to their non-MSI counterparts. The authors would also like to acknowledge only 17.2% of the respondents were MSI-affiliated, necessitating a more expansive and inclusive data collection process to enhance the robustness and generalizability of the findings. While perhaps not statistically significant, the faculty responses (Figures 8 & 9) indicate differences in faculty concerns about online learning as identified in H1.

Faculty skills enhancement needs were identified in previous studies (Asgari et al. 2021). However, the results presented here consider the institutional level and structural concerns that might exist at MSI. While not the purpose of the original study, MSI respondents appear to have less teaching experience and a reduced teaching load providing an opportunity for additional research. This should be compared to the higher expectation for AEC faculty teaching load, which when combined with research may cause a faculty retention problem (Griffith and Altinay 2020). Low faculty retention could account for an increase in early-career faculty. The initial hypotheses point to a known concern in MSI which could be due to structural differences between MSI and other institutions (Asgari et al. 2021 and Garcia et al. 2019, USOCR 2021). Non-MSI universities faculty match the rate of white persons in the construction industry, while MSI universities have an increased rate of non-white faculty. The data provides an exciting result the null hypothesis was not proven. Differences were found in faculty perceptions even if not statistically significant. Additional research must be performed to determine where the structural impacts exist, either positive or negative.

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