Transforming Education Pedagogies to Include Life-Work Balance in Engineering

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Abstract

The Construction industry is a dynamic, demanding, and challenging workplace for the recent engineering graduates entering the workforce. The construction industry is evolving as globalization continues to generate transformation in the industries. Therefore, education institutions must evaluate and implement the changes in the curriculum that provide the industry with a skilled workforce. Work-life Balance (WLB) has become a challenge to the industry as the next generation understands that having WLB is a priority in their career. This study focuses on understanding the work-life balance's influence on the Millennium generation entering the workforce. A survey was provided to 161 university students in the construction industry, and the results provided from the survey were analyzed. This study aims to provide academic institutions recommendations for the shift in priorities that the workforce must adapt to in the recruitment and retention of the construction industry. In recent years, the STEM professions have lost talent to other industries because the generations currently entering the workforce misconstrue the work-life balance (WLB) expectations pertaining to engineering, architecture, and construction industries. Construction careers can be highly stressful, with pressures such as achieving tight program deadlines, meeting the needs of multiple stakeholders, dealing with disputes, and enforcing the safety of all individuals on site. To this end, there is a growing need for pedagogical tools to prepare our workforce to succeed in the construction industry. The study aims to address the student's disconnect of perception/expectations of professional career challenges by educating them about work-life balance while working as Construction Engineers or Managers in the construction industry. To achieve these goals, the study utilizes a three-step methodology: a) conducting industry professionals' interviews, b) conducting surveys of construction management students predominantly in a minority-serving institution to determine how significant work-life balance is when working for an organization, and c) recommending different curricula changes to better prepare recent graduates to thrive and adapt when entering the engineering and construction industry. The study results indicated that inadequate work-life balance could result in project delays, higher project costs, and a devastating effect on the employees' mental and physical health due to demanding schedules. The study's findings contribute to the architecture and construction engineering body of knowledge by promoting work-life balance awareness among millennials and providing a pedagogical solution to foster retention and satisfaction within such industries.

Keywords: Work-life Balance, social sustainability, Construction Management Students, Construction Management Curricula

Background and Motivation

According to the United States of America Bureau of Economic Analysis report for the first quarter of 2022, the construction industry's nominal value added was 4.1 percent of the GDP and is projected to reach a Compound Annual Growth Rate of 5 percent from 2022-2026 [1]. This projection of industry growth exacerbates the ongoing crisis of the current workforce shortage in

the U.S. construction industry. As the Millennial generation continues to enter the workforce while the Baby Boomers generation is approaching retirement, there is a growing concern that traditional engineering and construction education systems do not prepare students for various workforce challenges, and the workforce demand will not be met in a timely manner. Baby Boomers are the generation born between 1946 and 1964 that are currently in management and leadership positions. Baby Boomers' generation stands out with novel characteristics, including (1) they consider work equivalent to self-worth; (2) they are competitive in the workplace; and (3) they are clever, resourceful, and strive to win [2]. On the other hand, the Millennial generation includes individuals born between 1980 and 2000. They have unique characteristics such as digital natives, enthusiastic, tech-savvy, entrepreneurial, opportunistic, more demanding in the workforce, and willing to change jobs to manage their perception of work-life balance continuously. In recent years, the STEM professions have lost talent to other industries because the Millennials and Generation Z misconstrue the expectations related to work-life balance (WLB) pertaining to Architecture, Engineering, and Construction (AEC) industries. Organizations need to become dynamic as the Baby Boomers generation starts to leave the workforce and the Millennial generation enters the workforce. The Baby Boomers generation is from the mentality of entering a job and remaining their entire career with that organization, growing the company, and increasing in the ranks to promote self-worth and supporting the organization. The generation currently entering the workforce does not have this loyalty approach and moves from job to job depending on their workplace experience. Baby Boomers believe in a hierarchal structure, loyalty to the employer, and rankism. Regarding specific age groups, in the third quarter of 2021, 66.9 percent of 65- to 74-year-olds were retired, compared with 64.0 percent in the same quarter of 2019. The leading edge of the Baby Boomer generation reached age 62 (the age at which workers can claim Social Security) in 2008. Between 2008 and 2019, the retired population ages 55 and older grew by about 1 million retirees per year. In the past two years, the ranks of retirees 55 and older have increased by 3.5 million [3].

Work-life balance is the ability of individuals to successfully pursue their work and non-work lives without undue pressures from one undermining the satisfactory experience of the other [4]. It is crucial for the construction industry that work-life balance must be incorporated into the construction workplace and that educational institutions can prepare the future workforce for the industry’s challenges. The concept of work-life balance has evolved in response to a changing culture where work has become more demanding of both sexes and free time has become less available, in turn increasing pressures in both domains and causing endemic work-life imbalance [5]. The change in culture, social rights, and generation have been pushing away from the house-home traditional model of male breadwinner to dual-winner income households where both partners work and contribute to family responsibilities. Despite all this transformation, educational institutions have remained with the theoretical approach to education. Educational Institutions stand in need of pedagogical tools to set students entering the workforce to succeed in the construction industry. There is a disconnect between the perception/experience provided in their education years and recent graduates' challenges when managing home and work life. The younger generation entering the workforce expects more flexible working practices and is more mindful of not over-committing themselves and achieving work-life balance [5]. The perspective of the younger generation leads to engineering employees changing careers or employees looking for organizations that meet their expectations.

The Bureau of Labor Statistics presented in April 2022 that the engineering profession needs to grow by 15 percent to meet increasing demand and replace retiring baby boomers. Employment in architecture and engineering occupations is projected to grow 6 percent from 2020 to 2030. Associated General Contractors of America's (AGC's) 2022 national survey report indicates that 83 percent of firms report difficulties in finding qualified employees and are concerned with inexperienced skilled labor – particularly in the craft trades [6]. The industry must recruit and retain new and current talent to respond to the industry's growth challenge. Not addressing this growth challenge appropriately will result in project delays, higher project costs, and a devastating effect on the employees' mental and physical health because of the work demands. Work-life balance has become one of the essential items of the millennium generation and has become a challenge for organizations in the retention process. A balance between work-related and non-work-related responsibilities has become a global concern [7], as Mohd Noor et al. (2009) indicated.

The Construction industry is a dynamic, demanding, and challenging workplace. Jobs in the construction industry can be highly stressful, with responsibilities such as achieving tight program deadlines, satisfying the needs of various stakeholders, settling disagreements, and guaranteeing the safety of everyone on-site [8]. As globalization continues to transform different industries, the workplace is undergoing a transformation with the shift of generations and the change in workforce priorities. Long working hours and weekend work are prominent features of many construction jobs, and they are attributed to work-life conflict, impairing employees' ability to achieve work-life balance. Women's employment rates have increased while men's rates have remained constant, resulting in fewer hours available outside work to manage life responsibilities [5]. Recent Graduates entering the construction workforce are presented with the impression that the industry will foster a work-life balance and get disappointed with the reality of the construction industry's time and effort demands. Work-life balance is about creating and maintaining supportive and healthy work environments, enabling employees to balance work and personal responsibilities and thus strengthening employee loyalty and productivity [9]. Therefore, this study aims to investigate the impact of different factors or priorities that impact students' academic performance and provide recommendations for helping students make better priorities for work-life balance. Consequently, this would assist the construction industry in recruiting and retaining the young workforce. As presented by the United States of America Bureau of Economic Analysis report for the first quarter of 2022, the construction industry's nominal value added was 4.1 percent of the GDP and is projected to reach a Compound Annual Growth Rate of 5 percent from 2022-2026. This projection of industry growth exacerbates the ongoing crisis of workforce shortage that exists in the construction industry currently in the United States.

Methodology

The study adopted an exploratory approach to investigate students' expectations of professional career challenges by educating them about work-life balance while working as Construction Engineers or Managers in the construction industry. The authors conducted a survey to determine the importance of work-life balance for students to take a job. The obtained quantitative and qualitative survey data from university students are analyzed using descriptive analysis.

Survey Design

The research team surveyed participants from students of minority-serving university engineering departments. The study aims to address the students' expectations of professional career challenges by educating them about work-life balance while working as Construction Engineers or Managers in the construction industry. To achieve the objectives goals, the study utilizes a three-step methodology: (a) conducting industry professionals' interviews, b) conducting surveys of construction management students predominantly in a minority-serving institution to determine how significant work-life balance is when working for an organization, and c) recommending different curricula changes to better prepare recent graduates to thrive and adapt when entering the engineering and construction industry. The survey included open-ended, multiple-choice, Likert scale, and demographic questions to validate these goals. Furthermore, the Likert scale questions focused on identifying the participants' motivation to select employees based on the employer's benefits. At the same time, the demographic questions recorded participants' year of study, A&E professional degree, and age. An online surveying tool, Qualtrics, was used to distribute the survey for two months. Then, the score obtained by each student is analyzed by using box plots. Box plots are one of the most common methods for graphically analyzing the distribution of data sets [10]. The box in the box plot typically includes the interquartile range of the dataset, i.e., values between the 25th and 75th percentile. A dark horizontal line represents the median value in the box. A whisker or lines extending above and below the box indicate the largest and smallest observed values.

Results and Discussion

Interview with Industry Experts

In this study, the authors interviewed four professionals that work in the construction industry talent recruitment for private and public organizations. When interviewing industry experts about the new generation of employees and the efforts for recruitment and retention, they expressed several concerns. The primary concern of the new generation is that the workforce has a vast opportunity to select different areas of the engineering field and out of the engineering field. A significant workforce demand gives graduating engineers a wide range of alternatives to what organization they want to work for and how long they stay there. The interviewees concur that creating healthy expectations about the construction industry will help new employees enter the workforce. The interviewees were asked what the central concern employees express when leaving the organization is, and they reported: (1) lack of a well-defined career path; (2) the extensive traveling required to execute the work; and (3) lack of reception that the experienced generation provides. Traveling requires moving from job site to job site and often being away from family and friends. In some instances, it involves working in remote locations. New employees want to ensure their personal life is not affected by the transitions from project to project. As far as the career path, new employees want to make sure there is a clearly defined career path in the organization. Employees also expressed that senior employees need to be more receptive to the new generation's mean methods and opinions, resulting in a loss of motivation. Employees want their opinions and perspectives to be valued and respected, as they want to add value to their organization. The interview participants expressed that the potential employees

want guarantees about the work-life balance and are concerned that the organization will not provide time for their personal life.

Survey of Engineering and Construction Management Students

This study collected responses from 161 civil engineering and construction management students of a minority-serving institution. The participating students provided insight on: (1) work-life balance issues related to our workforce and their success in the engineering and construction industry; and (2) different factors that would influence them to take a job offer in the construction industry. The recorded data included a diverse group of students, which included (a) students from multiple races, including African American, White, and Asian, among others; (b) students from different age groups, where 68.96 percent are 18-25 years old, 27.66 percent are 26-39 years old, 2.13 percent are 40-60 years old, and 2.13 percent preferred not to say; (c) 57.45 percent males, 42.55 percent females; and (d) 38.30 percent are first-generation university students, the remaining 61.70 percent are not first-generation university students as shown in Figure 1.

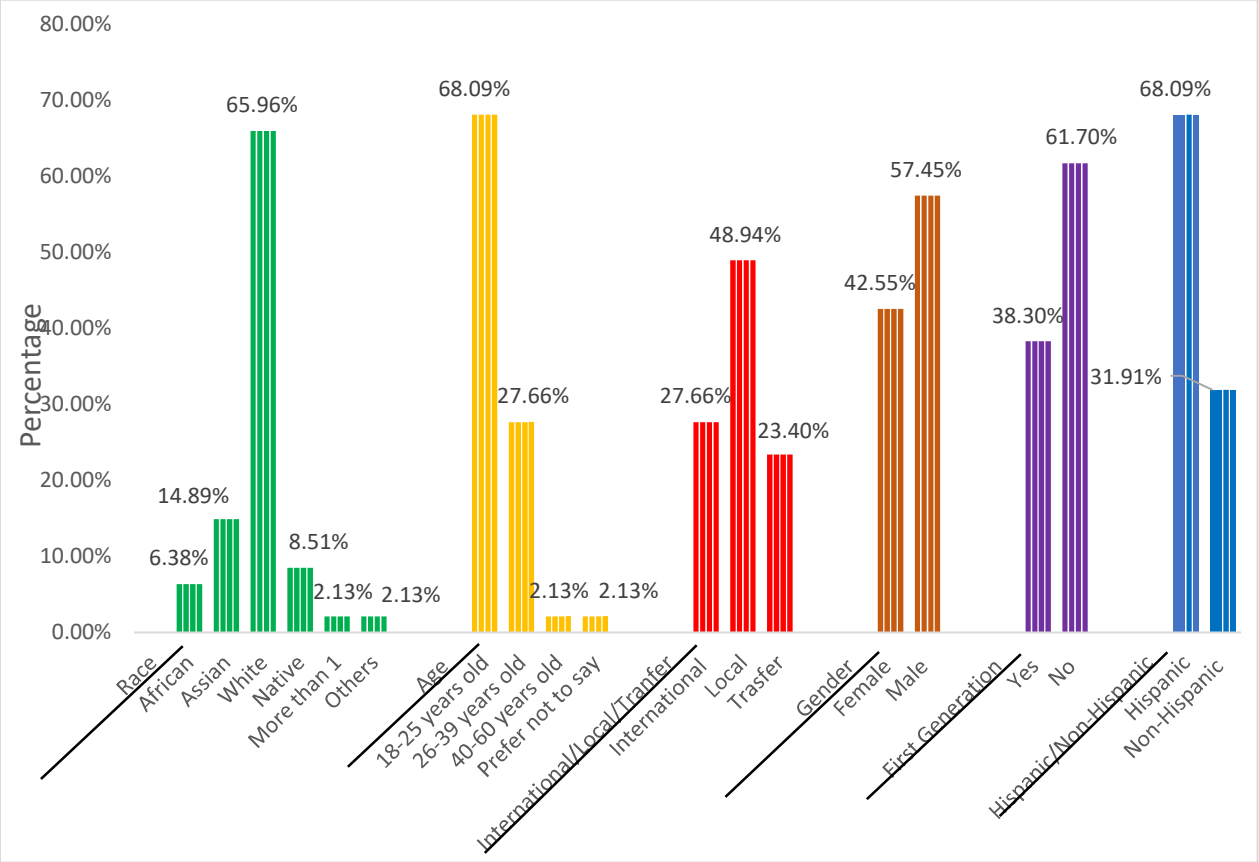

Figure 1. Survey Demographics

Students who participated in the survey were from different academic levels. 62 percent of students are seniors and juniors, while 27 percent are graduate students. Similarly, 6 percent of respondents are sophomores, and 4 percent of respondents are freshmen, as shown in Figure 2.

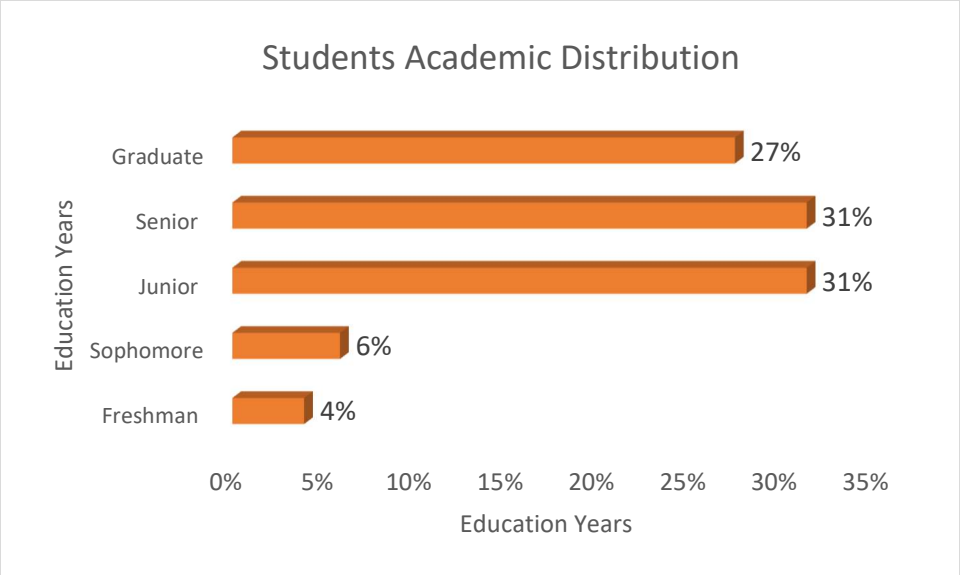

Figure 2. Students' Academic Distribution

Students were asked about the importance of work-life balance in their careers, as shown in Figure 3. Demonstrates that 59 percent of respondents identified that it is very important for them. 13 percent of respondents indicated that it is important, 11 percent of respondents had a neutral response, 9 percent of respondents reported that work-life balance is less important, and 12 percent of respondents reported that work-life balance is not important.

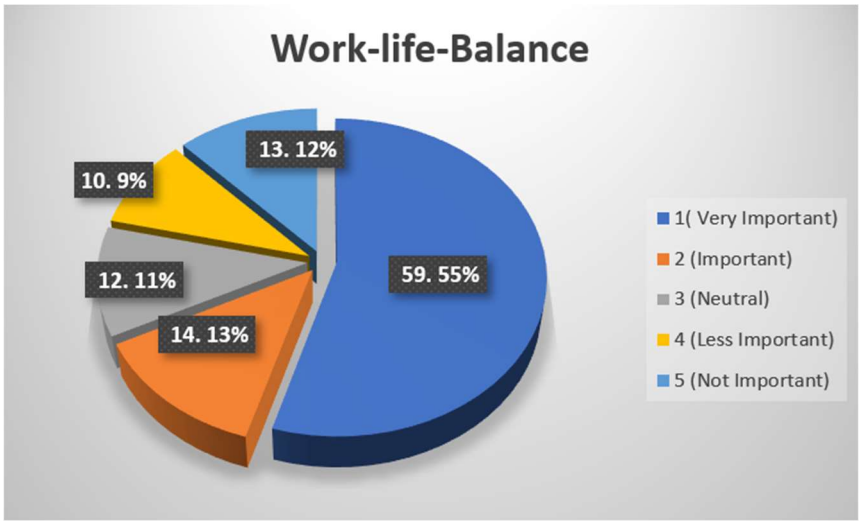

Figure 3. Students' perspective on work-life balance

This research also provides a descriptive statistical analysis of the influence of WLB in student job selection using box plots. Box plots are one of the most common methods for graphically analyzing the distribution of data sets [11]. The authors utilized box plots to evaluate the students' priorities when accepting a construction industry job offer. The box in the box plot typically includes the interquartile range of the dataset, i.e., values between the 25th and 75th

percentile. A dark horizontal line represents the median value in the box. A whisker or lines extending above and below the box indicate the largest and smallest observed values. Students provided ratings on a five-point scale where one represents "Very Important," and 5 represents "Not Important." As shown in Figure 4, students reported that Work-Life Balance, Job Offers, Professional Development, and Benefits such as 401K are important, as indicated by the median value of 1. On the other hand, students' ratings showed that factors like job location and organization prestige are somewhat important when accepting a job offer, which is indicated by the median value of 2. Therefore, it is clear from the box plots that work-life balance is a priority for students when accepting a job offer.

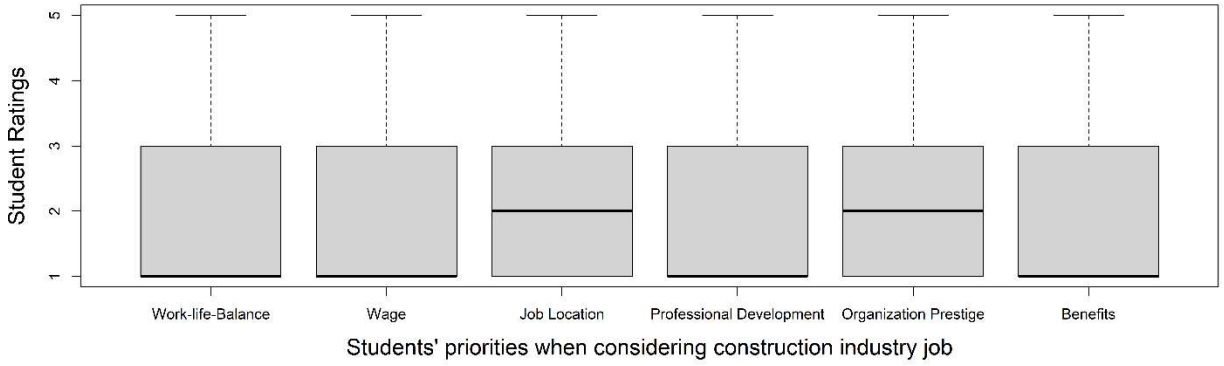

Figure 4. Box Plot of Students' priorities when considering construction industry jobs

Limitations and Future Work

The research acknowledges some limitations, such as the subjective nature of the survey responses due to the participants' personal opinions and self-judgments. However, the authors believe correlating the survey questionnaire to relevant literature supports valid conclusions and judgments. To improve the survey data and design a better curriculum, the authors aim to integrate the industry further to elaborate the effect in priority of work-life balance to different levels. Another limitation is the cross-sectional nature of the data used. Thus, a longitudinal design with a larger sample size should be employed when testing the hypotheses developed in future research. Furthermore, future research will focus on the improvement of work-life policies in an organization that can incorporate a family-friendly transition from academia to professional life in the construction industry. Presenting future professionals with tools such as conflict management, emotional intelligence, and effective time management courses can be provided as a future study, and results evaluated to categorize the influence to prepare a well-rounded professional.

Recommendations

1. **Company Internships and Co-op**: Companies can provide students with part-time or partial hours with a program that can expose them to internships. Internships have been hailed as powerful career boosters, and researchers have generally found positive

associations between internships and career-relevant variables. Theoretical and empirical studies indicated that internships have positive effects on engineering education. Engineering and technology students learn to gain much experience from different approaches [12]. Our findings show that internships also have a crucial effect on subsequent academic outcomes. These effects influence prior academic achievement, and they hold for both the advantaged and disadvantaged [13]. The analysis from a national dataset of 2004 seniors suggests that students who spent more time in a cooperative education program are better at ensuring that a process or product meets a variety of technical and practical criteria by comparing and judging alternative outcomes than students who have little or no experience in a co-op [14]. The internship program creates an authentic environment that does not occur in students' classrooms. Besides, internship programs help students acquire new concepts and ideas not covered in classroom instruction [12].

2. **Industry Mentoring Programs**- As part of the curriculum with industry partners and professional organizations, a mentoring program to assist students with the transition and different questions. Mentoring is an effective strategy in adult education, industries, and business sectors. Mentoring helps to share working experiences and facilitate students learning. Duquette (1998) points out that students maximize their learning and develop professional practices while they are counseled and advised by experienced mentors. It plays a prominent role in industry, culture, and education[12].

3. **Trades/ Rotations**- The construction industry has many trades, and recent graduates that enter the workplace are limited to academic exposure to those trades. Developing a trade inspection course can expose the students to different specifications with a hands-on approach and exposure to more personal experience in the field. This will enhance the student's understanding of the construction industry and improve students problem-solving and management.

4. **Workshop/Courses-** These workshops or courses have the desired outcome of presenting the students with different real-industry scenarios and working on emotional intelligence, finances, effective time management, and conflict management skills. The ability to manage these areas prepares the student for the possible life situation of the construction industry.

Conclusions

Recent engineering graduates entering the workforce may consider the construction industry to be a dynamic, demanding, and complex workplace. As globalization continues to trigger industry transformations, the construction industry is changing from what the Baby Boomers experienced. Consequently, educational institutions must evaluate and implement curriculum modifications that provide the industry with a skilled workforce understanding of the challenges. Work-life balance (WLB) has become a difficulty for the industry as the upcoming generation recognizes the importance of WLB for their careers. This study has three theoretical and methodological contributions to the literature. It will: (1) advance our understanding to address work-life balance issues related to our workforce and their success in the engineering and construction industry; (2)

inform the literature on how to reform our education curriculum to accommodate the necessary tools needed to prepare students to succeed in the construction industry; and (3) provide recommendations that can be implemented not only by the institution that offers engineering degrees but in the organization that would like to improve their retention. The results of this study show that work-life balance, job offers, and professional development are critical for the millennial generation when considering employment with an organization. The findings show that the WLB is a priority during the employment process in the construction industry. Consequently, Educational Institutions incorporating modifications to curriculum to include workshops, courses, Company Internships, Co-op, Trades/ Rotations, and Industry Mentoring Programs to present students with different authentic-industry scenarios will have positive results in the desired outcomes. Furthermore, developing students' essential skills such as emotional intelligence, finances, effective time, and conflict management will boost industry retention and recruitment. Education Institutions would be providing students with essential tools to manage their WLB accordingly. Students are significantly impacted by how recently graduated students are informed about their professional life, the time the profession will take from their non-work life, and their career expectations. This discovery contributes to the body of knowledge by enabling academic institutions and organizations to develop practical engineering courses, give the industry a deeper understanding of the challenges the construction industry faces, and work on managing the expectation of the workforce. It is essential to establish different processes to assist students entering the workforce in assimilating to industry demand while reducing stress factors that will motivate them to leave the construction industry. The recommendations provided in this study would promote the workforce to be inclusive, sensitive to cultural variations, and fair and impartial in resolving social inequalities.

References

[1] "Gross Domestic Product, First Quarter 2022 (Advance Estimate) _ U.S. Bureau of Economic Analysis (BEA)," 2022.

[2] Sally Kane, "How Baby Boomer Traits and Characteristics Affect the Workplace. ," Oct. 07, 2019. https://www.thebalancecareers.com/baby-boomers-2164681 (accessed Feb. 08, 2023).

[3] R. Fry, "Amid the pandemic- a rising share of older U.S. adults are now retired," Nov. 2021.

[4] M. B. P. Noon, *The Realities of Work*. 1999. Accessed: Feb. 08, 2023. [Online]. Available: https://www.jstor.org/stable/259089

[5] E. Morrison and D. Thurnell, "Employee Preferences for Work-life benefits in a Large New Zealand Construction Company," 2012.

[6] AGC, "Construction Hiring and Business Report," 2022.

[7] H. R. Hooja, "WORK-LIFE BALANCE: AN OVERVIEW," Jan. 2018. [Online]. Available: https://www.researchgate.net/publication/348164280

[8] H. Lingard and V. Francis, "The work-life experiences of office and site-based employees in the Australian construction industry," *Construction Management and Economics*, vol. 22, no. 9, pp. 991–1002, Nov. 2004, doi: 10.1080/0144619042000241444.

[9] B. Dhas, "A report on the importance of work-life balance," 2015. [Online]. Available: http://www.ripublication.com

[10] M. Hubert and E. Vandervieren, “An adjusted boxplot for skewed distributions,” *Comput Stat Data Anal*, vol. 52, no. 12, pp. 5186–5201, Aug. 2008, doi: 10.1016/j.csda.2007.11.008.
[11] N. C. Schwertman, M. A. Owens, and R. Adnan, “A simple more general boxplot method for identifying outliers,” *Comput Stat Data Anal*, vol. 47, no. 1, pp. 165–174, 2004, doi: 10.1016/j.csda.2003.10.012.
[12] A. T. Birhan and T. A. Merso, “Supporting engineering education through internship mentoring program: Approaches, perceptions and challenges,” *Journal of Technical Education and Training*, vol. 13, no. 1, pp. 185–194, 2021, doi: 10.30880/jtet.2021.13.01.020.
[13] J. F. Binder, T. Baguley, C. Crook, and F. Miller, “The academic value of internships: Benefits across disciplines and student backgrounds,” *Contemp Educ Psychol*, vol. 41, pp. 73–82, Apr. 2015, doi: 10.1016/j.cedpsych.2014.12.001.
[14] A. Yin, “AC 2010-59: UNDERSTANDING COOPERATIVE EDUCATION AND INTERNSHIPS: THE INFLUENCE ON ENGINEERING STUDENTS’ PROBLEM SOLVING SKILLS Understanding Cooperative Education and Internships: The Influence on Engineering Students’ Problem Solving Skills,” 2010.
[15] S. C. O. Conceição, A. Samuel, and S. M. Yelich Biniecki, “Using concept mapping as a tool for conducting research: An analysis of three approaches,” *Cogent Soc Sci*, vol. 3, no. 1, Jan. 2017, doi: 10.1080/23311886.2017.1404753.