Reading Between the Data Points: Analysis of the VSFS Internship Recruitment Process and Its Implications for Engineering Student Applicants

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1. Introduction

Engineering internships are important, providing students with opportunities for skill acquisition and real-world industry experiences. Unfortunately, internships can be very competitive and thus, hard to obtain especially for students attempting to thrive during a pandemic or for students living in geographically dispersed areas. In an attempt to overcome these challenges, virtual internships have become a new reality for most organizations [1]. Virtual internships have several advantages that other conventional internships do not have. Virtual internships offer flexibility that not only enables students to complete tasks on time but also creates an optimized work-life balance. Additionally, students can work from anywhere across the globe and collaborate with peers and mentors from multiple countries and disciplinary backgrounds. Furthermore, virtual internships have been found to increase motivation and enable students to learn better [2] by allowing them to have more flexibility, mobility, and autonomy in their work [3]. Yet, little is known about how to facilitate, expand, and market virtual internship processes. The purpose of this study is to respond to the following guiding research question: *What internship posting characteristics lead to the highest number of applicants?*

2. Background

2.1 Virtual Internships

Internships provide students with opportunities to learn and apply the knowledge and skills learned to achieve desirable outcomes; also, internships are essential, and the programs allow students to develop professional skills [4]. Traditional in-person internships are rare to come by for students, it has [1]significant challenges, such as inadequate mentorship for students during internships, some do not provide opportunities for the students to engage in real-world problems, and the college calendar varies across institutions [5]. [1]This requires new methods of internship opportunities for students, such as a virtual internship. A virtual internship is a computer-based, virtual job experience program where the participants, primarily students, play the role of professionals. Participants work on authentic tasks and activities together in a group while engaging in complex professional thinking [6]. Engineering virtual internships provide an authentic engineering experience for students in their first year; it is individualized and accommodates many engineering students [7].

2.2 Benefits of Virtual Internships to Students and Employers

Virtual internships are beneficial to both engineering students and their employers [5]. Currently, there is a mismatch between the engineering labor markets and the supply of technical skills in the field and virtual internship opportunities assist in bridging these skill gaps. Virtual training allows engineering students to relate what they learn in the classroom to real-world settings, and what they would experience in the workforce. Furthermore, engineering students engaging in virtual training programs also positively impact the industry employers seeking engineering graduates who have both the technical and vocational skills that would benefit and enhance

productivity in their companies [8]. Additionally, virtual internships are essential for students to succeed in the 21st-century workplace, and in many cases serve as a prerequisite for employment [9]. Virtual internships provide opportunities for students who find it challenging to undertake traditional internships due to issues related to the internship sites [10]. Different reasons might hinder students' chances to take or accept on-site internship opportunities; for instance, students who have family or work full-time would find it challenging to relocate to another state for internship opportunities. The virtual internship would help bridge the gaps. Furthermore, according to Kraft, Jeske and Bayerlein [11], embracing virtual internships has a lot of benefits for employers. Firstly, the employers who provide virtual internships have the benefit of hiring individuals from a vast pool of talent across national and international boundaries. Secondly, virtual internships are inexpensive compared to traditional in-person internships.

2.3 Challenges with Virtual Internships

Although virtual internships offer several benefits, challenges remain. First, there is a lack of communication entailing supervision, mentoring, and peer interaction [12]. In this regard, not all virtual internship opportunities encourage or ensure effective communication between supervisors and student interns. Second, the number of initial investments required to establish and facilitate virtual internships may be costly [13]. Some companies may not already have the technology and technical infrastructure to implement virtual internships successfully for many students. Just as the infrastructure or capacity to cater to online education had to be built, there is a need to develop an infrastructure for the virtual internship if it would be successful. Third, not all programs are conducive to integrating virtual internships [14]. Some degree programs favor on-site internships, as employers may believe that the best way to prepare students for the workforce is to ensure they are present in the company's geographical location, increasing the students' learning opportunities. Fourth, some students lack the skills to succeed in virtual internships [15]. According to Xiao [16], students participating in virtual internships must possess the same skill set needed for online study or education. However, the students who have never taken online courses or engineering students in their first year without online study experience would likely find the virtual internship challenging and difficult for them to achieve the goals of the virtual training.

2.4 Focus of This Study: Virtual Student Federal Service (VSFS) Internship Program

The United States government is home to the Virtual Student Federal Service (VSFS) internship program [17]. The program targets college and university-level students and aims to connect prospective applicants with several civic engagement-focused opportunities while working with various government agencies [18]. For example, student interns can work with the Bureau of Indian Affairs (BIA) on improving the web user interface for people with disabilities, the Veterans Affairs (VA) Department to optimize access to trauma counseling for veterans, and the Centers for Disease Control and Prevention (CDC) to create awareness around public health emergency preparedness. Ultimately, students get experience developing novel solutions to real-world problems (e.g., improving accessibility, technological innovations, process optimization, and many more) [17, 18].

The VSFS job posting process is very structured and repetitive year-to-year. In May, several government agencies submit their intern project proposals. Following this, the VSFS program coordinators vet the projects to ensure they are a good fit for the program. Then internship postings are uploaded to the VSFS portal by July 1 and become available for students to start their applications. Once the postings are live, the VSFS coordinators rely on non-technical advertisements (e.g., campus visits, word-of-mouth, physical flyers) to market the program and get students to visit the VSFS online platform. Although this advertising approach can be expensive and ineffective, the platform has received many visitors and applicants throughout the past decade. However, the problem exists in the high variance of applicants across the various postings. During the 2019-2020 academic year, the posting with the highest quantity of applicants received 316 applications. Moreover, 213 postings received less than 5 applicants and 15 of the internship postings received 0 applicants. Of the 635 internship positions posted on the VSFS portal, only 212 positions were applied to by engineering majors (according to self-reported data). These statistics suggest that the VSFS internship postings do not adequately and effectively communicate the project needs required by U.S. government agencies.

3. Methods

3.1 Data Collection

This study followed a mixed-methods approach using secondary data obtained from the VSFS program coordinators. During the 2019-2020 academic school year, there were 635 internship positions posted on the VSFS portal. However, of those postings, 213 positions have received less than 5 applicants; 15 positions have received 0 applicants. Given the disparity in applicants across all 635 internship postings, the secondary data collection efforts were limited to the top thirty postings with the highest quantity of applicants and the bottom thirty postings with the lowest quantity of applicants. This would allow for extreme categorization which should make the themes easier to identify. First, the qualitative secondary data was obtained through the VSFS postings accessible from the VSFS portal website (https://vsfs.state.gov/projects#all-projs-tab). The qualitative VSFS postings were collected to conduct a thematic analysis, which is further explained in the next section. Second, the quantitative secondary data was obtained by making an official request directly to the VSFS government coordinators. The quantitative secondary data provided the quantity of applications submitted for each of the VSFS postings.

3.2 Data Analysis

This study followed a mixed-methods approach. First, qualitative analysis was conducted to identify themes. Second, quantitative analysis was conducted to analyze the statistical relationship, if any, between the themes and quantity of applicants.

The qualitative analysis was done using thematic analysis. According to Braun and Clark [19], a thematic analysis is a foundational qualitative method for discovering patterns within the data which should be conducted using a step-by-step process. The NVivo 12 qualitative analysis software was used to analyze sixty VSFS postings. Specifically, thirty postings with the highest quantity of applicants and thirty postings with the least amount of applicants were analyzed. All data documents were imported into NVivo and the researchers read through the documents

several times. The researchers first became thoroughly familiar with the data to generate initial codes. Two researchers individually coded and highlighted the documents to identify themes. Upon completion of the independent analysis, the researchers compared their results, read through the documents again, and came to a consensus for developing themes and a coding framework. As a final step, the researchers revised and finalized the themes. The researchers debated the strengths and weaknesses of strictly conceptualizing themes without quotes and heavily using quotes to provide readers with evidence. It was decided to merge the two philosophies and meet in the middle, providing two examples of each theme. For each example, quotes were drawn from the data to allow readers to make their own judgments on credibility, accuracy, and fairness [20].

As a second step, coding the qualitative data allowed quantification and prioritization of the themes through basic statistical analysis [21]. MiniTab software was used to quantitatively analyze the coded themes with respect to quantity of applicants. Descriptive statistics and correlation analysis were applied.

4. Results

4.1 Qualitative Analysis to Develop Themes

The final themes that resulted from the qualitative analysis are summarized in Table 1.

Table 1. List of Themes – Description and Examples

1. Concise: The internship posting is efficient and was clear about the purpose of the role and gives necessary additional information in a concise way.
Yes (1) - Example: Seeking an intern willing to chart political and economic trends, identify areas to enhance U.S. trade and investment, and track Russian commercial and political influence in Belarus and the region.   *No (0) - Example: The intern will assist the U.S. Embassy in Santiago's economic team in its engagement with the Republic of Chile in the areas of trade, mining, energy, macroeconomics, and finance. Embassy Santiago's economic team will develop the specific objectives and timelines with the virtual student intern.*
2. Discipline: The internship posting explained what specific kind of skills the potential candidate needs to have, or specify their degree or technical background required.
Yes (1) - Example: Russian language skills, academic background in international economics and/or international affairs recommended but not required.   *No (0) - Example: Key skills required are comfort interviewing and writing about subjects/areas with limited familiarity – think a reporter, willingness to learn/adapt, interest in serving the public good*
3. Objective: The internship posting lists straightforward tasks and expectations, whereas little is left to the imagination. Task expectations and processes follow a checklist approach instead

of being given ambiguous or subjective assignments.
• *Yes (1) - Example: The intern will conduct open-source research to develop weekly summaries of significant events in Belarus's economic and political sectors, map relationships and biographical history of key players in Belarus's government and economy, and contribute to the development of talking points and social media posts.* • *No (0) - Example: The expectation would be to publish papers, provide a technical presentation and provide a basis to update Superfund risk assessment practices.*
4. Reasonable Scope: The work interns were expected to accomplish was within a reasonable scope. At the same time, the posting mentioned the "instructing/guiding person," the mentor interns will work with.
• *Yes (1) - Example: This internship is perfect for students interested in working on or having experience researching/writing about the intersections between economic development and government policy, domestic and regional politics, foreign investment, and the challenges of modernizing a planned/demand economy.* • *No (0) - Example: We were thinking this individual would spend the internship doing the following during any given workweek: (1) interviewing subject matter experts and executives, (2) summarizing and transforming the interview notes into an article, and (3) helping with the development and execution of a communication plan.*
5. Virtual: The tasks mentioned in the postings appear feasible for the interns to accomplish in a remote setting.
• *Yes (1) - Example: Social media skills are a big plus - please include in your submission a short sample tweet or post about a political or economic issue in Belarus.* • *No (0) - Example: The photographer will have opportunities to photograph employees, Veterans, and activities surrounding readjustment counseling at Vet Centers, but will also manage and edit the photos coming in from staff throughout the country. The photographer will be expected to provide captions for photos that are used and obtain written consent from VA staff and clients.*

4.2 Quantitative Analysis to Analyze Themes

MiniTab software was used to quantitatively analyze the coded themes with respect to quantity of applicants. Descriptive statistics and correlation analysis results are provided in Table 2 and Table 3, respectively.

Table 2 provides the descriptive statistics for each of the five themes and the dependent variable, quantity of applicants. For all five themes, the posting was rated a 'Yes' = 1 if it responded positively to the theme; the posting was rated a 'No" = 0 if it responded poorly to the theme. For example, the theme *Concise* had a mean of 0.8, which means that 80% of our sample postings (n = 60) received a 'Yes' = 1 when considering the code *Concise*. Similarly, the theme *Objective* had a mean of 0.6, which means that 60% of our sample postings (n = 60) received a 'Yes' = 1 when considering the code *Objective*. The only variable without binary coding is the 'Qty of

Applicants', which has a mean of 31.25. This variable has a high standard deviation as the posting with the highest quantity of applicants received 316 applications, while many of the postings in the bottom thirty received few, if any, applications.

Table 2. Descriptive Statistics for Each Theme and Dependent Variable (Qty of Applicants)

Variable	Mean	SE Mean	StDev	Minimum	Maximum
Concise	0.8000	0.0521	0.4034	0.0000	1.0000
Discipline	0.6500	0.0621	0.4810	0.0000	1.0000
Objective	0.6000	0.0638	0.4940	0.0000	1.0000
Reasonable Scope	0.8167	0.0504	0.3902	0.0000	1.0000
Virtual	0.8667	0.0443	0.3428	0.0000	1.0000
Qty of Applicants	31.25	6.31	48.90	0.00	316.00

Table 3 provides the correlation analysis when considering each theme with respect to the dependent variable, and quantity of applicants. Using the traditionally accepted alpha value of 0.05, which results in a 5% risk of error, two of the themes (*Concise* and *Objective*) are found to be statistically significant. Yet, *Reasonable Scope* and *Virtual*, although not statistically significant, resulted in a p-value slightly greater than the 0.5 alpha value. The theme, Discipline, is not found to be statistically significant and suggests a negative correlation between 'Yes' for *Discipline* and *Qty of Applicants*. In summary, the two statistically significant themes, *Concise* and *Objectives*, had correlation scores (with *Qty of Applicants*) of 0.284 and 0.395, respectively.

This result indicates that the internship postings that were successful in attracting intern applications were *Concise* and *Objective*. Per the definitions in Table *1*, *Concise* postings provided efficient and clear information about the purpose of the role and gave necessary additional information in an easy-to-understand way; *Objective* postings listed straightforward and checklist approach to tasks and expectations instead of giving the impression of ambiguous or subjective assignments.

Table 3. Pearson Correlations Comparing Theme with Quantity of Applicants

Sample 1	Sample 2	N	Correlation	p-value
Concise	Qty of Applicants	60	0.284	0.028
Discipline	Qty of Applicants	60	-0.179	0.171
Objective	Qty of Applicants	60	0.395	0.002
Reasonable Scope	Qty of Applicants	60	0.236	0.069
Virtual	Qty of Applicants	60	0.237	0.069

5. Discussion and Conclusion

5.1 Summary and Key Takeaways

The purpose of this study was to respond to the following guiding research question: *What internship posting characteristics lead to the highest quantity of applicants?*

To respond to this research question, the researchers first conducted a thematic analysis to understand the underlying characteristics which had the potential to materialize within the internship posting. The final themes that resulted from the thematic analysis are summarized in Table 1. Then, the researchers conducted a correlation analysis to assess which of the characteristics, or themes, was most influential in leading to the highest quantity of applicants. Two of the five themes were found to be statistically significantly correlated with the number of applicants, including *Concise* and *Objective*. *Concise* postings provided efficient and clear information about the purpose of the role and gave necessary additional information in an easy-to-understand format. *Objective* postings listed a straightforward and checklist approach to tasks and expectations instead of giving the impression of ambiguous or subjective assignments.

Human resource managers and internship program managers should be particularly cognizant of these design components when creating new virtual internship postings. Concerning *Concise*, managers should consider being more specific with the virtual internship expectations. Although posting vague expectations allows for flexibility and a change of plans once the intern is hired, per the study findings shown in this manuscript, vague expectations can be a turn-off for many applicants. Concerning *Objective*, managers should consider taking an objective and straightforward approach to assignments versus leaving the intern with limited guidance and promoting subjectivity when assigning tasks. Although posting ambiguous assignments can empower the intern to take ownership of the assignment, the findings suggest that ambiguity and subjectivity in completing assigned tasks can be a turn-off for many applicants.

5.2 Limitations and Future Research

This study had a few noteworthy limitations. First, this study only evaluated one year's worth of VSFS program data. Future studies should consider evaluating all ten years of the VSFS program data. This would allow for a more complete picture and potentially identify patterns over time. Second, this study used secondary data. Although secondary data is used often in research, it prevented the researchers from following up directly with participants and government agency internship hosts. Future research should consider obtaining primary data and conducting interviews or focus groups to dig deeper into the phenomena. Third, this study only investigated internship postings via the U.S. government-sponsored VSFS. Future research would benefit from analyzing virtual internship postings from a variety of online websites and offline flyers. Fourth, this study focused only on the top 30 virtual internship postings which had the highest number of applicants, and the bottom 30 virtual internship postings which had the least number of applicants. A benefit of this approach was the decreased effort in developing the themes. Future research should benefit from assessing a larger sample size of internship postings. Lastly, the analysis was conducted during the pre-COVID-19 period. Future research would benefit by assessing student interest in applying for internships during the COVID-19 pandemic period.

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