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Understanding Student's Perceptions of Cultural Dimensions in construction majors: Deconstructing barriers between architecture and civil engineering students

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Pilot Study - Understanding Student's Perceptions of Cultural Dimensions in construction majors in Ecuador: Deconstructing barriers between architecture and civil engineering students

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Abstract

Designing infrastructure demands architects and civil engineers to converge into an effective workflow in the real world. However, this type of collaboration is almost non-existent in most academic settings. In fact, students are taught different approaches to design and problem-solving which can translate into issues and delays at work. As a result, the purpose of this study is to explore how architecture and civil engineering students perceive different dimensions associated with culture. We are applying Hofstede's theory of dimensions of national cultures to measure students' perceptions on individualism, power distance, uncertainty avoidance, masculinity and long-term orientation. We collected data from 110 students during the Fall 2021 in Ecuador at Universidad San Francisco de Quito USFQ. Before administering the online survey, it was translated into Spanish and was reviewed by several native Spanish speakers. The results provide insight into the prevalent differences between the fields of architecture and civil engineering. We discuss the possible factors driving these differences and explore the avenues academia could take to reduce barriers for cooperation.

Introduction

Just over a century ago infrastructure was made only by one type of professional who was both architect and civil engineer. It was not until 1818, that a schism between these professions happened. On one hand, the institute of Civil Engineers appeared in Britain. On the other hand, in 1834, the Royal Institute of British Architects was formed [1]. Since then, each profession specialized in different aspects of infrastructure: one focused on the engineering and structural issues and the other, on the design qualities of its functionality. Over the last century, it seems as though this gap has grown both in academia and the workplace.

This study hypothesizes that this ever-growing distance can be approached by understanding the cultural differences developed since the academic years of both professions. Culture is defined as the manifestation of behavior belonging to the same group of people in the form of shared "symbols, values, believes, cognitive abilities and stereotypes" [2]–[4]. Even though culture is a multilayer phenomenon, evaluating aspects of it can result valuable to understand the cognitive distance between architecture and civil engineering students and therefore, propose pedagogical interventions that lead to cohesive collaboration in the field [5]–[7].

Although, conflict between these construction professionals is often under reported or under investigated. There is research that suggests that barriers of communication and collaboration between civil engineers and architects stem from the trepidation of architects—as project managers—to include civil engineers from the start of a project [8]. On one hand, civil engineers seem to doubt the structural competency of the architects. On the other hand, architects doubt the capacity for creativity and innovation from civil engineers. As a result, there are frustrations and constant misunderstandings that lead each profession to not feel valued and reinforce patterns that lead to negative working environments [8]. This evidence suggests that there are clear behaviors that are related to dimensions of culture as proposed by Hofstede's theory of culture.

This study focuses on architecture and civil engineering students from Ecuador, where research on higher education is lacking and dates as far as 1992 [9]. In the country, most universities offer architecture and civil engineering careers in separate departments with little to no opportunities of collaboration between both types of students. As a result, when joining the workforce, new infrastructure professionals are faced with challenges that lead to delays and lack of efficiency. In order to quantitively assess culture within these groups of students, a study at Universidad San Francisco de Quito USFQ—a liberal arts, private university in the capital of Ecuador—was developed applying Hofstede's theory of cultural dimensions [10]–[13] and using the modified questionnaires proposed by Sharma [14]. The purpose of this paper is to explore the culture of these two infrastructure related majors in Ecuador. We argue that understanding these cultural dimensions can help develop new strategies and pedagogies to improve the education of students within these disciplines. The goal is to obtain a more coordinated construction workforce to minimize conflicts caused by misunderstandings due differences between disciplines.

Background

Hofstede's theory of national culture

This study applies psychologist Geert Hofstede's model of national culture as a practical framework. This model developed in the 1980s, when he conducted a series of surveys to 116 000 IBM workers from 40 different countries, aiming to characterize common traits and beliefs within different societies at a national level [10], [15]–[17]. The quantitative analysis of these surveys revealed five common expressions of culture, each defined with two opposite poles. In the model, the poles serve to mark the ends of a spectrum in which societies or individuals may fall [18]–[20]. The five expressions of culture are power distance, individualism, uncertainty, masculinity and long-term orientation. ***Individualism*** pertains to the relationship between an individual and a group. **P*ower distance*** is the degree to which people with less power "expect and accept" uneven distribution of power in a society. ***Uncertainty avoidance*** refers to the extent to which people can operate under uncertainty. ***Masculinity*** indicates the degree of assertive and caring traits of a society that allows to characterize it either as assertive (masculine) or caring (feminine) [18], [21]. Finally, ***long-term orientation*** refers to the "fostering of virtues oriented towards future rewards, in particular, perseverance and thrift" [18].

In recent years, although valuable, Hofstede's five dimensions were reframed into ten personal cultural orientations by Sharma [14], [22], [23]. The purpose of this restructuring was to consider these five dimensions as multi-dimensional continuums instead of unidimensional constructs. As a result, Sharma [14] adjusted Hostede's questionnaire. According to Sharma [14], Hofstede's theory of national cultures may be too general to detect nuances between different sub-groups from a single country. At the same time, Hofstede's model fails to acknowledge that people may change their tendencies depending on the task they are required to do [24], [25]. For instance, a person might be individualistic at work but not necessarily with his family. Additionally, it is possible that non-cultural factors like, socio-economic status, environment, and demographics, provide explanations as to why there are differences between countries [26]. Finally, dimensions may not be well defined. For example, instead of measuring individualistic and collectivistic behavior, Hofstede's model treats them as direct opposites [14]. So, if a person is not individualistic, therefore she must be collectivistic, which may not be the case. Consequently, understanding cultural dimensions as Sharma proposes allows to capture culture as a fluid spectrum and not a rigid categorization.

Although Hofstede's theory applies to culture to categorize consumer behaviour in a national sense, it may also be applied to academic disciplinary settings [13], [27], [28]. In fact, research developed over the past three decades suggests that applying Hofstede's theory produces valid and consistent results [2], [29], [30]. Thus, this model will be taken as a reliable tool to contrast both infrastructure disciplines within an Ecuadorean context.

Cultural Context in Ecuador

Hofstede's findings for Ecuador were accessed through his virtual tool and compared against countries from other regions like United States, the Netherlands and China to establish a cultural benchmark at a national level [31], as shown in the figure below.

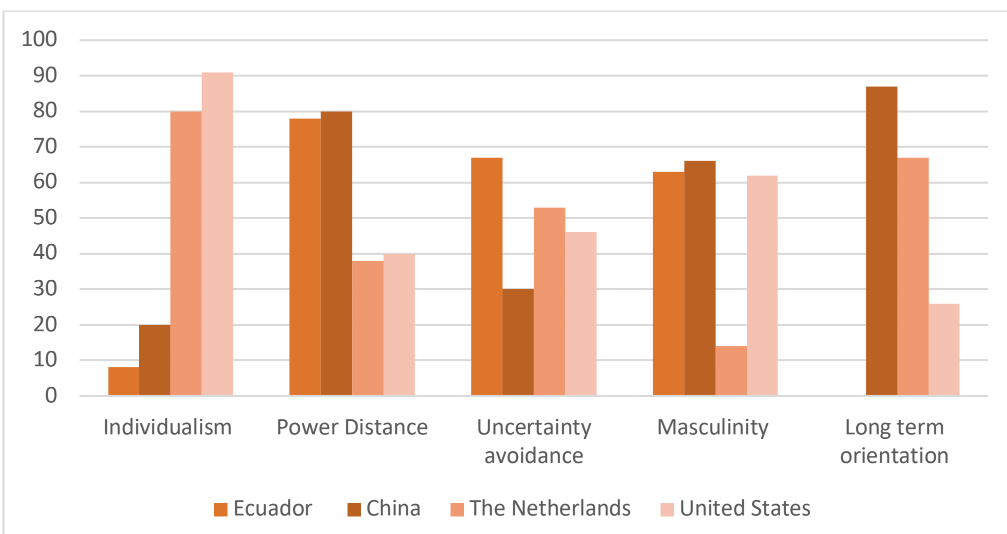

Figure 1. Comparison between Ecuador, China, The Netherlands, and United States applying Hofstede's theory of national culture.

Pertaining to individualism, Ecuador scores almost ten times less than the United States and The Netherlands and half as low as China. This shows that individuals prefer or value belonging to groups and in general, opt for collective behaviors to maintain the group's harmony [18]. In contrast to this dimension, in terms of power distance, Ecuador shows an acceptance of uneven power distribution almost twice as much as the US and the Netherlands. At the same time, it shows similar results to those from China, were the government has a large involvement in social life. In general, this reflects a society that normalizes inequalities within the social fabric and is more likely lean towards structured hierarchies of power.

According to the results on the uncertainty avoidance dimension, Ecuador ranks higher than the US, China and The Netherlands. This dimension describes the extent to which society can accept the unknown. A higher percentage suggests Ecuador is less likely to accept ambiguity. Nonetheless, this does not mean Ecuadorean society easily accepts rules. On the contrary, rules are only followed if leaders – not necessarily, political leaders— deem them applicable to the members of a specific group [2] . Finally, as of now, Ecuador does not have a score for the dimension of long-term orientation within Hofstede's on-line tool.

Additionally, in terms of masculinity Ecuador seems to lean more towards being driven by competition, achievement, and success [18]. This tendency lays within the centric thirty per cent of the spectrum like that of United States and China; which strips away the stereotype that all Latin American people avoid hard work [2], [30]. Finally, Ecuador does not have a score related to the long-term orientation dimension.

Analyzing national scores allows to establish a benchmark and a point of comparison, for the analysis of architecture and civil engineering students. For instance, in the case of Ecuador that has a relative low score in individualism, it would be expected that students would also share the same traits. However, it is possible the opposite shall be found and then, research would have to focus on the microcosm of academia and explore why university work may not be conducive towards collaboration.

Construction majors in Ecuador and at Universidad San Francisco de Quito USFQ

Universities in Ecuador offer two professional majors related to the infrastructure field at the undergraduate level: civil engineering and architecture. In contrast, at a global scale, there are three majors related to the conception of infrastructure: architecture, civil engineering and construction engineering/management with more than 20 areas of specialization. In Ecuador, civil engineering students may share their faculty with other engineers, while architecture students may fall under the faculty of arts, history, and design.

Throughout each major, there are different ways to develop activities that require group or individual assignments. Knowing these methods is relevant to understand how collaborative work is fostered. In the first semesters of civil engineering at USFQ, in some activities and in almost all laboratories, teamwork is promoted. Consequently, engineering students are equipped with the soft skills required to handle group dynamics. On the other hand, architecture students only start to do collaborative work in their last semesters. At the beginning they only carry out individual work with the intention to develop their own their personal design knowledge. The projects that are carried out in groups are of a maximum of 4 people compared to civil engineering where you can find teams of 5 to 6 participants. Working in bigger groups helps individuals know how to manage and organize people when carrying out collaborative work. Universities should stimulate individuals to cooperate with each other not only as a tool for the development of effective teamwork but also to promote the individual understanding of his role in a group.

This research was conducted at Universidad San Francisco de Quito USFQ which is the first Liberal Arts university in Latin America and the only one in Ecuador. It is located on the country's capital, Quito. According to QS University Ranking, USFQ ranked #1 in Ecuador and #50 in Latin America. This private university enrolls about six thousand undergraduates and about five hundred graduates every year. It also has a minority program, which provides scholarships to more than one hundred students from ethnic groups every year. Here, the civil engineering program falls under the Science and Engineering faculty with an average of 25 students per professor. Additionally, there are two specialization programs: Master's in Civil Engineering with mention in Seismic Design and Construction, and Master's on Management of Construction Companies. At the same time, the architecture program falls under the Architecture and Interior Design faculty averaging 670 students and a ratio of 27 students per professor. Currently, there are no specializations offered to architecture undergraduates. Following the national model, there are two distinct majors related to the construction at USFQ: civil engineering and architecture. These majors are not within the same college, nor do they share specific career classes. Students from these majors may share general courses together as well as with students from other unrelated careers.

Methodology

To get our data, we used the survey adapted by Sharma [14] to measure personal cultural orientations in civil engineering and architecture majors at USFQ. The first step was to have an appropriate translation of the survey to avoid any misunderstanding or confusion of the questions. The survey was taken physically to the students of the careers mentioned before. It was sought that surveyed students were in their last semesters of the degree. The survey was administrated to a total of 110 students, having 39 to civil engineers and 71 to architects. The survey consists in 45 question, 5 multiple choice and 40 scale questions been 0 strongly degree and 5 strongly agree. They were divided in eight sections to make easier to the surveyed to focus on similar questions and easier to be analyzed.

The results were process and managed using Excel, data of 110 surveyed students were analyzed using t-student distributions and a p-value of 0.005 for each question and section to determine if the differences in cultural dimensions between majors were significant. There were around five to 8 questions per dimension, so an average of each section was obtained per person. For the first dimension, a score closer to 5 (strongly agree) indicates a person who is more individualistic. Then, for the second dimension if the average is closer to 0 (strongly disagree) it is more likely that the student is less comfortable with uneven distributions of power. The third section is about uncertainty avoidance, so the closer to 5 it gets the individual is less comfortable with uncertainty. The fourth section is about masculinity, the lower the average score goes the individual is more equalist or feminist. Finally, for the fifth category of long-term orientation, a closer score to 5 represents an understanding of the long-term impact of what their professions entail.

Results

The overview of the results of the survey for the two infrastructure majors are presented in table 1. The results show the sample size per major, the arithmetic mean and standard deviation found for each dimension under each investigated major. Simultaneously, tables 2 through 5 show the results for the student t-test analysis for each dimension analyzed under a confidence interval of 95%.

Table 1.Arithmetic mean, and Standard Deviation found between architecture and civil engineering students under Hofstede's theory of cultural dimensions.

Major	**n**	**Cultural Dimensions**									
		Individualism		**Power Distance**		**Uncertainty avoidance**		**Masculinity**		**Long-term orientation**	
		Mean	**St. Dev**	**Mean**	**St. Dev**	**Mean**	**St. Dev**	**Mean**	**St. Dev**	**Mean**	**St. Dev**
Civil Engineering	39	4.41	0.28	2.63	0.62	3.08	0.66	3.85	0.54	4.17	0.67
Architecture	71	4.53	0.45	3.34	0.84	3.75	1.01	2.86	0.69	4.70	0.62
Total participants	**110**										

The mean scores of all dimensions are presented in table 1; the higher the score in a scale of 1 to 5, the higher the tendency towards the described dimensions. These scores show several differences and few similarities between civil engineering and architecture students. On one hand, the scores for individualism are close and higher than 2.5 which suggests that both majors prefer not to work in collective settings. On the other, in terms of power distance, uncertainty avoidance and long-term orientation civil engineers score lower than architecture students. This suggests, for example, that civil engineering students are less accepting of hierarchies and can deal with uncertainty at a higher degree than architecture students. Architecture students score lower in the dimension of masculinity, which suggests that these students value the principles of competition at a lesser degree than civil engineering students.

Comparing the results of these sub-groups with national results, the most significant difference is that of individualism (figure 2). The national scores suggest that Ecuadoreans lead towards collective action, whereas students within these majors show a tendency towards a more individualistic behavior.

Cultural Dimensions similarities and differences between both infrastructure majors

Using Hofstede's theory of national cultures as a practical framework of analysis, several insights about the behavior and culture of civil engineers and architecture students were obtained. Table 2 intends summarize the comparison between majors. First, for the **Individualism** dimension, both types of students had a statistically equal tendency towards

individualism. In fact, a student t-test analysis was used to analyze both scores. With an $\alpha = 0.05$ and a p-value of 0.11, the results suggest that there is no significant difference between both majors in terms of their individualistic tendencies. **In terms of individualism,** architecture students scored 4.53, while civil engineering students scored 4.41. It is important to keep in mind that the highest possible score was 5, which suggests that both professions fall on the more individualistic side of the spectrum.

For the remaining four dimensions, which were analyzed through a t-test with an $\alpha = 0.05$, the results —p-value lower than 0.05— showed there was a significant difference between each major. In terms o**f Power Distance,** which is concerned with the acceptance of hierarchies and thus, the results show an uneven distribution of power. Architecture students had a mean score of 3.34, while civil engineers had a mean score of 2.63. For **Uncertainty Avoidance**, architecture students scored a 3.75, while civil engineering students scored a 3.08. Furthermore, under the **Masculinity** dimension, civil engineering students obtained a mean score of 3.85, while architecture students scored 2.86. As a result, civil engineers scored statistically higher than architecture students within this dimension. In fact, this is the largest difference found between both majors. Finally, pertaining to **Long-term Orientation**, architecture students exhibited a mean score of 4.7, while civil engineering students showcased a score of 4.10. According to the t-test with a CI of 95%, these scores were significantly different, as shown in Table 2.

Table 2. Cultural dimensions similarities and differences between infrastructure majors.

DIMENSIONS	**Student t-test**	**Check**
Individualism	0.11	Not significantly different
Power distance	0.00	significantly different
Uncertainty avoidance	0.00	significantly different
Masculinity	0.00	significantly different
Long Term Orientation	0.00	significantly different

Figure 2 shows the scores of architecture and civil engineering students compared to the national average scores.

This preliminary research paper attempted to understand the culture behind infrastructure related majors in a private Liberal-Arts school in Ecuador. At the same time, the study aimed to contrast architecture and civil engineering's student culture, to better reconcile both professions. The study applied Hofstede's theory of cultural dimensions as a framework of quantitative evaluation. **The evaluated cultural dimensions are individualism, power distance, uncertainty avoidance, masculinity, and long-term orientation.** In general, there was a statistically significant difference between both majors in four out of the five dimensions. The only category where there was no difference in results was individualism. The following section will discuss our findings and ways of moving forward towards new avenues of research.

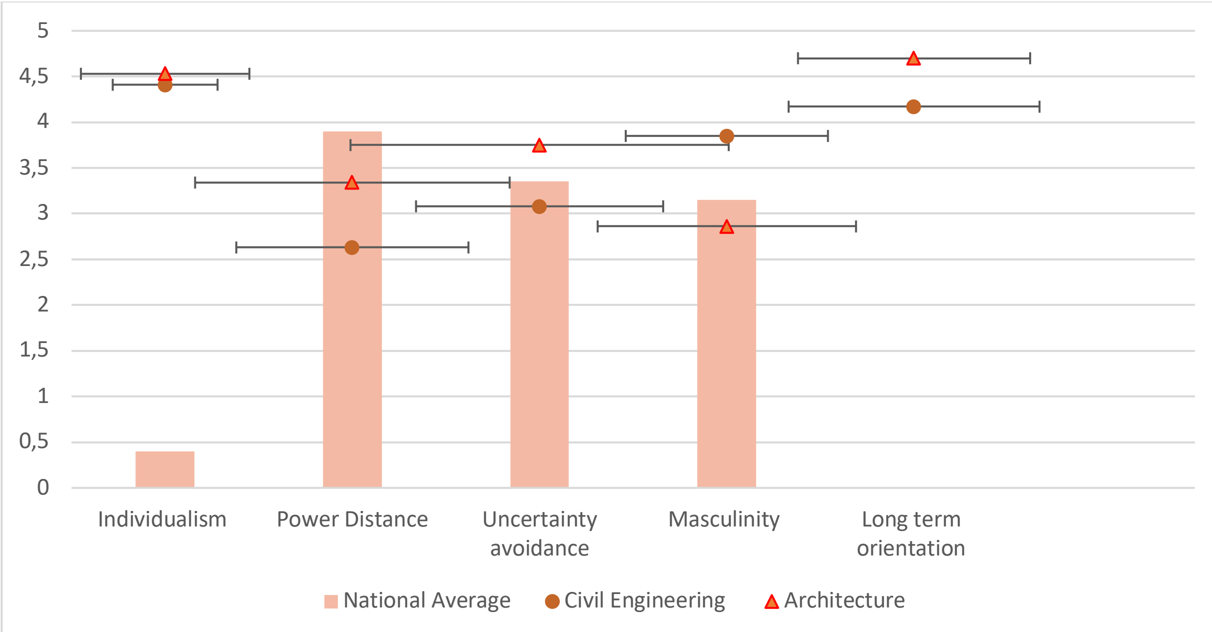

Figure 2. Relation between the national average scores, and civil engineering and architecture students' scores.

Individualism

Individualism in this context reflects on the preference to value frameworks that would only benefit oneself. Having individualistic tendencies may bring forward a barrier towards teamwork, which is found in the professional realm [8]. Both professions scored in the higher-end section of the spectra, while the national score is 0.4. **This trend was expected given the competitive nature of both majors. Architecture students** are often subjected to public scrutiny during their review sessions and **are pushed to work on big projects by themselves**. **Civil engineering students are also evaluated individually since the initial core engineering courses**. **This suggests that either there is an intrinsic preference for individual work beyond the scope of academia— a cognitive preference perhaps inherent of the people who chose certain professions —or that the type of group projects provided to both majors is not conducive to foster collective views and therefore, enhance better teamwork**. Reasons for having low preference for teamwork may be the lack of initiative from team members and a reluctancy to delegate tasks [8] which may lead to lower grades. However, research on the reasons for individualistic preferences should be further conducted.

Sharma (2010) suggests**, it is expected that cultural dimensions may be dynamic or fluid because they depend on the context where they are being measured**. So, architecture and civil engineering students may be individualistic on an academic setting but may be more collectivistic in their personal lives. This insight provides an opportunity to dismantle barriers for teamwork, namely creating spaces for multi-disciplinary voluntary competitions that may have no effect on grades. At the same time, within classes, initial architecture and civil engineering courses for structural conceptualization may be taught for both groups, encouraging discussion within a controlled environment.

Power distance

Higher score in this dimension suggests that individuals from a group are more compliant with structures of power and vice versa. Both professions scored in the mid-section of the spectra and scored more than the 2.5; which suggests that **there is a slight preference towards accepting uneven distribution of power amongst both groups. These could be due to two factors. First**, academic life always involves some sort of hierarchy where teachers tell students what to do. It is rare to see –at the undergraduate level—classes where there are no hierarchies. **Second**, these scores are congruent with the national mean which is 3.9 when converted to a 5-point scale which suggests that these scores could also be due to the general national culture found in the country.

Particularly, the results show that architecture students gravitate towards an acceptance of hierarchies. **This could be due to the nature of architecture's practice and academic life which places value on self-image, social status and public acceptance of their designs which are all factors related to this dimension** [14]. For example, throughout their career architects seek approval of their designs during critiques, while civil engineers have concrete indicators that let them know if a design works or not with no personal involvement. Additionally, **this finding may also suggest that architecture students value hierarchies more because they seek to rank themselves higher, since their work I s more explicit to the public eye**.

This acceptance and disapproval of hierarchies may lead to communication-related barriers. In practice, architects are at the top of the project hierarchy due to being the design creators. So, it may be difficult for them to accept criticism from civil engineers who are revising the structural and system-related components of the infrastructure. At the same time, civil engineers —who are less accepting of hierarchies, although still in the higher end of the spectrum—may be defiant towards their creative counterparts, which may lead to conflict. Research suggests that including both architects and civil engineers from the start of a project may help resolve conflict. In other words, knowing where each profession is coming from with the conceptualization of a project allows for the reductions of tension [8], [32]. Academia represents, therefore, a great space to reconcile both professions and reduce the perceived distance between civil engineers and architects. For example, academic interventions that encourage the development of shared-leadership interventions in order to instate a collaborative workflow from the start.

Uncertainty avoidance

This dimension refers to the extent to which people feel adversity towards uncertainty or the unknown. A higher score suggests feeling a tendency to reject risk. **B**oth academic professions scored close to the national mean of 3.35. However, architecture students scored statistically higher than civil engineering students. Consequently, architecture students tend to be more reluctant about the introduction of uncertainty than civil engineering students. In terms of behaviour, groups with higher uncertainty avoidance tendencies are more likely to stick to structured situations and may not challenge belief systems; whereas groups with lower uncertainty avoidance scores are more likely to accept new ideas and lean towards innovative behavior [14], [33]**.**

This result does not fit the stereotype showcasing explicitly “creative” people being less structured and more “free spirited” than technical professions. In fact, architects often accuse civil engineers of being too structured and reluctant to change [8]. However, one important aspect of this dimension is that people with higher uncertainty avoidance tend to be more emotional than people with a lower score [31]. Now**, this result may be a reflection on how both majors differ from one another in terms of education**. For instance, design for architecture students is a complex realm because it is highly subjective and it is not mainly driven by physical laws and indicators like it is for civil engineers.

In practice, reluctancy to change is common and it is considered another barrier for collaboration and communication. This may be rooted on traditional academic practice. In fact, throughout the past year, several articles citing toxic academic and professional settings have been brought forward regarding architecture practice to hopefully change “studio” culture worldwide [34]. On one side, architecture students spend a large portion of their career on design sprints and critiques. In fact, architecture students are often overworked and are expected to invest massive amounts of time on their studio work. So, when architecture students show their work and get criticism there is bound to be an emotional and maybe even personal response. On the other side, structural design follows certain indicators and norms that showcase the performance of a design which directly informs students of whether they have to change some elements or not. This gives civil engineering students an opportunity to feel more comfortable with change. In addition, critiques do not occur with frequency in the career of civil engneering (at USFQ). This insight is valuable to understand any reluctancy of architecture professionals to changing their designs in the workplace. Academic interventions that tackle uncertainty avoidance related barriers may focus on dismantling said toxic culture starting from breaking down traditional paradigms and the requirements they put forward, in both majors. However, more research is needed to recognize underlying causes for uncertainty avoidance in academic life.

Considering the national culture score provides a base level to comprehending and finding significant differences within sub-groups of a particular society. As a result, there is potential to develop cross-cultural research and be able to determine whether national cultures are reliable predictors or that there are common cultural traits amongst architecture and civil engineering students across the globe regardless of their culture. This type of research could lead to the creation of general academic interventions to foster collaboration between construction majors.

Masculinity

A higher score suggests a tendency towards assertive traits such as competition, aggressiveness, lack of empathy, facts, and conflict whereas a lower score suggests a preference for mediation, empathy, human interaction, emotions, etc [35]. Civil engineering students scored higher than architecture students in this dimension. **Due to the inherent nature of both majors—architecture being more stereotypically creative and civil engineering being more technical—these results were expected**. As mentioned previously, engineers are technical and stereotypically conduct their work in a cold, unemphatic and factual way. Conversely, architects create their designs based not only on their experience but also with the intent of considering the experience of those around them. As a result, there is an apparent incompatibility of approaches between architects and civil engineers in the workplace. However, this is not the case provided that both professions focus on different sides of the same project, they should be complementary. Consequently, academic interventions that foster empathy towards each-other may reduce imaginary barrier between creative and technical professionals. For instance, interventions may push civil engineers to gain notions of design and architects to know what the function of a civil engineer is within their projects.

It is important to note that civil engineering students score much higher than the national average (3.15) and architecture students score lower. It could be valuable to test whether there is a significant difference between the measured scores and the national mean to identify specific causes driving these patterns. At the same time, it should be mentioned that while "masculinity" refers to certain characteristics and not necessarily to male dominance, **the role that gender plays within these results is worth exploring. In the end, there is a larger population of male students in engineering and a larger population of female students in architecture.**

Long-term orientation

Having a higher score in long-term orientation suggests that there is a tendency to think about the future without being constrained by the past. In other words, a higher score reflects a predilection towards innovation instead of traditionalism. The results showed that architecture students scored higher than civil engineering students within the long-term orientation dimension. This is expected provided that architecture students are trained to think about their projects as permanent and meaningful, taking into account aesthetics and social concerns. At the same time, as discussed through other dimensions, the personal attachment between the architect and their legacy may also contribute to driving this score up. Meanwhile, civil engineering students are often focused on solving a specific structure with already established methods — at least at the undergraduate level. Here, frustrations may come up as grandiose designs may be countered by civil engineers. Research suggests that including the engineers from the start of a design, allows them to contribute with ideas to solve structural issues instead of opposing them altogether [8]. Academia could bridge said interaction from the start with spaces that allows both professions to interact. Finally, it is important to note that both scores are closer to the end spectrum, which **is expected due to the apparent permanent nature of both professions.**

Conclusion

The purpose of this research project was to perform a preliminary study to understand the cultural differences between the construction majors such as architecture and civil engineering in a liberal arts school in Ecuador, using Hofstede's Theory of Cultural Dimensions. This paper took the recommendations made by Sharma [14] to evaluate differences within five dimensions of culture including individualism, power distance, uncertainty avoidance, masculinity and long-term orientation.

There was a statistically significant difference across four out of the five dimensions between majors. Both majors obtained statistically equal scores for the individualistic dimension. In general, civil engineers statistically scored lower in power distance, uncertainty avoidance and long-term orientation dimensions, whereas architecture statistically scored lower in the masculinity dimension.

These results suggest that both majors lack a preference for collaborative work, which has the potential to generate communication problems in the workplace. At the same time, this study found that architecture students tend to be more emotional and are in general more concerned with the self-image of their designs which leads them to have a preference to avoid swaying away from their status quo. These emotional responses towards change may create friction between both disciplines when developing projects together. On the other hand, civil engineering students tend to be more rational and discontent with hierarchies, while being open to changes, more aggressive and performance driven. These characteristics may lead engineers to not be able to compromise with the architect's vision for the sake of efficiency.

The data was obtained from groups of students at Universidad San Francisco de Quito, a liberal arts university in Ecuador. Here civil engineers and architecture students barely collaborate with each other and often come out of their studies never having worked with each other. As a result, several recommendations can be made. For instance, there is a need for curricula to incentivize the interaction between both majors either within the academic setting or as extra-curricular activities. For example, encouraging voluntary multi-disciplinary competitions may foster teamwork while encouraging civil engineers and architects to understand each other's workflow. At the same time, academic interventions should intend to close the apparent distance between the creative process of an architect and the technical approach of a civil engineer through the fostering classes were both types of professionals can hold discussions. Furthermore, these interventions should focus on the implementation of soft skills such as leadership, empathy, and communication. Ultimately, there are interventions that need to be catered towards each specific career, for instance, tackling the studio culture in architecture practice as recent research suggests. Further research into the construction majors curricula is needed in order to propose further opportunities of interaction.

Finally, this study found that there are opportunities to further explore cultural dimensions amongst construction students cross-culturally. On one hand, some national scores predicted students' responses and some did not, which suggests that individuals within the construction industry may share certain traits with individuals from other countries but within the same professions. This may be significant to find common barriers and academic interventions.

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