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Cover Page Footnote

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RESEARCH

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Introduction

The global nature of the marketplace requires engineering students to develop the ability to work across different cultures (National Academy of Engineering, 2017). According to a report from the National Academies of Science, Engineering, and Medicine (NASEM) (2019), this intercultural ability is crucial for the new generation of engineering students, who will engage in complex global problems (Levonisova et al., 2015; National Academy of Engineering, 2017). Students must be prepared to understand and address such problems and to join and adapt to a diverse workforce. Experiential learning, of which study abroad programs are one example, is the primary vehicle used in most colleges of engineering in the United States (U.S.) to develop students' intercultural ability through internationalization. Internationalization is defined by Knight (2004) as "the process of integrating an international, intercultural or global dimension into the purpose, functions or delivery of post-secondary education" (p. 11).

According to a 2019 report from the Institute of International Education (IIE, 2019; Yates, 2020), 342,751 U.S. students engaged in study abroad experiences for academic credit in 2018. Undergraduate students constituted 87% of study abroad program participants, with 67.0% identifying as women and 30% from racial/ethnic minority groups. About 25% participated in short-term programs, which run for less than a full semester. Further, students in STEM majors were the largest group (25.7%) in short-term programs. But compared to the 36% of all U.S. undergraduates who major in STEM fields, STEM students are still underrepresented in study abroad programs and engineering students represent only about 5.3% of all students who study abroad annually. The statistics for STEM majors suggest relatively low levels of participation among engineering students. This lack of participation may represent a major limitation to the development of students' intercultural abilities and career readiness.

To overcome known barriers that prevent engineering students from participating in study abroad programs, virtual international experiences have gained much attention as a way to encourage similar kinds of student learning and growth (Marutschke et al., 2019;

Yates et al., 2020). Inspired by this approach, we launched the Virtual International Collaborative Experiential Program (VICEP) at the University of Cincinnati to connect students across institutions widely separated by geography, time, social practices, and culture while reducing associated financial and time commitments (Marutschke et al., 2019; Long et al., 2010). The more specific purpose of this paper is to explore students' motivation to be part of the VICEP based on Expectancy-Value-Cost Theory.

Background

Challenges for Study Abroad Programs

Social barriers constitute a major challenge to engineering students' participation and achievement in study abroad programs. Banov et al. (2017) surveyed 5,000 students who participated in a study abroad program and found that, despite pre-departure preparation, students faced a variety of social issues while abroad, such as making new friends (50%), being homesick (48%), balancing school and life (47%), and fitting in culturally (46%). These concerns are accentuated by the anxiety that results from losing the familiar signs and symbols of social intercourse common back home. In addition, financial barriers and the complexity of the engineering curriculum also limit students' participation. Indeed, given a large number of required courses and a lack of flexibility in a typical engineering curriculum, study abroad programs are not always an appealing option for many students, and are typically not recommended or required in engineering curricula. Further, given the significant cost of higher education in the U.S., extending their studies by one semester to participate in study abroad is simply challenging for most engineering students as it may delay their graduation.

Traditionally, two factors mitigate these barriers and influence students' choices and experiences in intercultural programs: their motivation and the destination. Motivation has been considered in study abroad research as a factor influencing students' participation and achieving the desired outcomes. For example, Anderson et al. (2015) found that student motivation for studying abroad plays an important role in influencing their program selection and determining what they will get out of the experience. Student motivation was also identified as a driving force leading to a life-altering study abroad experience. Additionally, students' commitment to a study abroad program was associated with the available destinations (Anderson et al., 2015; Vande Berg et al., 2009). Anderson et al. (2015), in turn, concluded that knowing what students seek to gain from their study abroad experience and their preference for geographic location could guide how to design study abroad programs to best facilitate students' intercultural development. That is, programs in more challenging locations could be presented in a fashion that makes it easier for students to see how it meets their goals (motivations) for studying abroad. Therefore, the nature and location of a program seem to be related to students' intercultural development (Vande Berg et al., 2009).

Further, Bandyopadhyay and Bandyopadhyay (2015) proposed a framework of factors that might influence students' participation in study abroad programs. However, the relationships among the factors has not been empirically tested and the decision-making for study abroad may be complex, involving many factors associated with students' perceptions of expectancy related to personal and intellectual growth, the value of

professional development for their career, and cost and time commitments. As proposed by Bandyopadhyay and Bandyopadhyay (2015), some factors of their framework can in turn be related to the Expectancy-Value-Cost theory, with expectancy driven by general perceptions and cultural awareness; value driven by the need for personal growth, intellectual development, and professional skills development; and cost driven by the duration and the financial cost of the study abroad.

Effects of the COVID-19 Pandemic on Study Abroad Programs

In 2020, the travel restrictions resulting from the COVID-19 pandemic brought traditional study-abroad programs to a complete stop. Clearly, the COVID-19 pandemic, with its international travel restrictions, disrupted engineering students' opportunities to participate in study abroad programs (Whalen, 2020). However, one of the pandemic's more lasting effects may be to challenge the assumption that studying abroad requires students to physically cross-national borders. Indeed, the pandemic's major strain on academic institutions reinforces the need for alternative methods to cover the academic outcomes of study abroad programs. As stated by Whalen (2020), studying abroad should be more generally viewed as an "educational framework that promotes the mobility of students' minds -- minds engaged in confronting other cultures and worldviews that help overcome their biases" (Whalen, 2020). Under this definition, study abroad programs could include alternative formats, such as virtual exchange programs, global education without mobility (i.e., domestic study away), or international collaborative projects.

As argued by Fischer (2021) and Custodi et al. (2020), colleges and academic leaders need to seize the watershed moment caused by COVID-19 to re-invent and re-assert international education by integrating "global learning in the curriculum, whether through standalone courses like the virtual classrooms [...], or by making it a core learning outcome of required freshman seminars" (Fischer, 2021, p. 29). Global learning can also mean emphasizing global experiences and perspectives in co-curricular activities, organizing international festivals, inviting speakers with diverse perspectives, and doing service-learning projects in refugee and immigrant communities. Fischer's recommendations are in turn supported by earlier propositions made by Twombly et al. (2012) to restructure intercultural experiences to meet contemporary expectations and needs. More specifically, Twombly et al. (2012) proposed that experiences be explicitly designed and delivered around precisely determined and clearly articulated educational outcomes and integrated as part of an educational sequence rather than as independent learning experiences.

The educational frameworks proposed by Fischer could alleviate traditional barriers to study abroad programs, and, if well structured, have the potential to achieve the same goals. Structured virtual international programs are likely to persist beyond the COVID-19 pandemic because of the relatively low barrier to entry and minimal interference with students' curricula. Virtual programs might be the best alternative for many students. The duration of the program could even be extended for more impact (Fischer, 2021; Whalen, 2020). Students can participate without the travel or extra costs typically entailed with studying abroad. Such low-cost options for gaining international intercultural experience may be attractive as the pandemic exacts an economic toll on students and parents. Additionally, virtual programs may alleviate the fear or uncertainty over healthcare and

safety measures which may also be important factors for students.

Knowing what drives students' motivation for virtual programs, their preference for the geographical region of the virtual partners, and what they seek to gain from a virtual study abroad program could provide educators and institutions with guidance on how to design these types of programs to best facilitate student outcomes. Programs with more challenging features, such as language and time zone differences, could be presented in ways that might encourage students to embrace and engage in such programs. One could potentially expect increased participation due to fewer social barriers/challenges, lessened financial burden, reduced time constraints, and better integration into the engineering curriculum.

In this context, the first author of this paper, faculty at a Research I institution in the United States, has leveraged the institution's global network with strategic partners worldwide to develop a virtual international collaborative experiential program (VICEP), along with internal grant support from the institution.

About VICEP

The Virtual International Collaborative Experiential Program (VICEP) is a non-credit, 12-week program in which students engage in international teams and complete a design challenge connected to a real-life problem. The program also includes activities for cultural exploration. The time commitment is estimated at five hours per week for meetings, design, and problem-solving activities, as well as cultural experiences. The time commitment is intended to be manageable alongside students' regular course load.

The VICEP aims to: (a) create teams of students from the University of Cincinnati and its strategic partner institutions worldwide, and (b) provide teams of students from different cultures with an opportunity to solve engineering-related real-life design challenges as an alternative to traditional study abroad programs during the COVID-19 pandemic. The structure and logistics of the VICEP were designed to avoid or limit challenges (logistics, communication, etc.) inherent to virtual collaboration and teamwork (Brewer, 2015; Lipinski, 2014). Through the program, students are expected to explore different ways of doing engineering in other countries, complete various engineering challenges, and interact with professors, engineering professionals, and students from other countries. Students also have the opportunity to present their projects at the undergraduate research showcase at the partner institution. The VICEP includes cultural experiences at three levels: (a) collaborative teamwork on an engineering-based problem; (b) virtual social and cultural interactions involving encounters and engagements with diverse communities in the U.S. or communities in the country of the partner institution; and (c) professional cultural interactions through seminars featuring speakers from each partner institution.

Methods

Purpose of the Study

The first session of the VICEP was conducted in the Spring of 2021 for first-year engineering students as a vehicle to develop their global competence and professional integration. However, before the implementation of the VICEP, it was unclear how first-

year engineering students would perceive an international collaborative experience like the VICEP. Understanding factors that may affect student motivation is important to prepare students before the VICEP, support them during the program, and meet their expectations. Therefore, we explored first-year engineering students' motivation to participate in the VICEP and their preferences for the geographic regions of the virtual partners. Aligned with these goals, we first modified an existing motivation measure for engineering students.

The research questions for this study were: (a) how valid and reliable is the modified motivation measure for engineering students?, (b) how motivated are students to engage in the VICEP?, (c) what are the factors increasing or decreasing their motivation?, and (d) what are their preferences regarding the geographical regions of partner institutions for the VICEP? In addition, we investigated gender differences in student responses to better understand this underrepresented population's engagement in the program. This paper focuses on student motivation and their geographical preference for a virtual program. Student outcomes and performance resulting from the first VICEP will be reported in a different contribution.

Participants

The participants in this study were students enrolled in a first-year engineering program during the fall 2020 semester at the University of Cincinnati. The total enrollment for first-year engineering students was 1,459 (see Table 1 for demographic information).

Table 1. Demographics of First-Year Engineering Students at the Institution

		Students Enrolled in 24 Sections		**Students Enrolled in 2 Sections**	
Category	**Subgroup**	*N*	*%*	*n*	*%*
Gender	Female	253	23.0	21	16.5
	Male	1,206	77.0	110	83.5
Ethnicity/ Race	Hispanic	52	3.6	9	6.8
	Asian	77	5.3	12	9.2
	Black or African American	41	2.8	8	6.2
	Native Hawaiian and Pacific Islander	1	0.1	0	0
	Two or more races	65	4.4	7	5.3
	White	1,125	77.1	92	70.2
	Unknown	15	1.0	3	2.3
Totals		1,459	100.0	131	100.0

The survey was accessible to 131 (83.5% males and 16.5% females) first-year engineering students enrolled in 2 of 24 sections of an Introduction to Engineering Design course; these sections were taught by the first author of this paper. Students self-selected into sections. These sections are assigned to instructors to accommodate their schedule. While students from only two sections were invited to complete the survey, this structure can be

considered plausible randomization of the study participants from the total students at the institution. Compared to all sections with 23.0% female and 6.5% underrepresented minority students, the two sections in question had fewer female students (16.5%) but more ethnic diversity with 13.9% from underrepresented minority groups. 116 students (21 females, 94 males, and 1 other) responded to the survey, resulting in a response rate of 87.8%. This sample represents 7.8% of the total first-year engineering students at the institution. Students' ethnic/racial information was not considered in the analysis below due to the small number of underrepresented minority students in the sample.

Measures

Expectancy-Value Theory (EVT) (Eccles et al., 1983) offers one of the most influential models for understanding motivation. It is centered on the importance of two components in promoting overall motivation: having an *expectancy* of being successful in a task and having a *value* for engaging in the task. The third component of this theory, *cost*, can be defined as how much a student has to sacrifice to engage in a task (Barron et al., 2017; Eccles, 2005; Matusovich et al., 2010). The three components of Eccles' Expectancy-Value-Cost motivation theory can be translated in the context of this paper as follows: *expectancy* reflects the extent to which a student thinks they can be successful in achieving the outcomes of the VICEP; *value* beliefs reflect the extent to which a student thinks it is worthwhile to complete the tasks related to the VICEP; and the *cost* factor reflects additional barriers (time constraints, language difference, time zone difference, etc.) that thwart students from being successful regardless of their expectancy and value.

The Expectancy-Value-Cost (EVC) survey of student motivation (Barron et al., 2017) was designed to measure three different aspects of motivation based on Eccles and colleagues' original Expectancy-Value model of motivation (Eccles et al., 1983). Flake et al. (2015) used exploratory and confirmatory factor analyses to operationalize the measurement of *cost* as the third dimension of motivation in the sense of Eccles. Barron et al. (2017) then developed a user guide for the EVC survey of student motivation. We selected and modified the survey items presented by Barron et al. (2017) to understand how students view the VICEP opportunity, such as what they expect (expectancy), why they want to participate (value), and how they perceive the associated costs (time and effort, etc.). The EVC has been validated for students in late elementary school through college (Barron et al., 2017).

The EVC survey items were slightly modified in this study to explore student motivation for the VICEP (see Table 2). The instrument has 10 items rated on a six-point Likert scale, ranging from 1 for Strongly Disagree to 6 for Strongly Agree. In the literature, the dimensions of the EVC survey had a reliability coefficient between Cronbach's $\alpha = 0.79$ and $\alpha = 0.89$ (Flake et al., 2015; Jiang et al., 2018; Kosovich et al., 2015).

In addition to assessing student motivation, two open-ended questions were utilized to understand the factors that may affect students' motivation. The questions were formulated as described by Barron et al. (2017) and presented to students as follows:

- In the space below, please list specific things that might INCREASE your motivation to engage and learn in Virtual International Collaborative Experiential

Program (VICEP).
- In the space below, please list specific things that might DECREASE your motivation to engage and learn in Virtual International Collaborative Experiential Program (VICEP).

Lastly, to explore students' preference for the geographic region of the partner institutions worldwide, we used our institution's geographic structuration of the world, which divides the world into seven strategic zones: The Americas (South America, Central America, and North America), Asia and the Pacific, China, Europe, India, the Middle East and Northern Africa, and Sub-Saharan Africa. The associated question was phrased, "Assuming that your academic schedule permits, rank your interest based on the location of the strategic partner institutions" with the aforementioned seven geographic regions as options. Note that although China and India are countries in Asia, they were separately zoned as geographic regions based on the institution's categories.

Table 2. Ten Items on the Expectancy-Value-Cost Survey of Student Motivation

Construct	#	Item
Expectancy	1	I can achieve the outcomes of this type of Virtual International Collaborative Experiential Program (VICEP).
	2	I can be successful in this type of Virtual International Collaborative Experiential Program (VICEP).
	3	I can understand the material in this type of Virtual International Collaborative Experiential Program (VICEP).
Value	4	This type of Virtual International Collaborative Experiential Program (VICEP) is important to me.
	5	I value this type of Virtual International Collaborative Experiential Program (VICEP).
	6	This type of Virtual International Collaborative Experiential Program (VICEP) is useful to me.
Cost	7	This type of Virtual International Collaborative Experiential Program (VICEP) requires too much time.
	8	Because of other things that I do, I don't have time to put into this type of Virtual International Collaborative Experiential Program (VICEP).
	9	I am unable to put in the time needed to do well in this type of Virtual International Collaborative Experiential Program (VICEP).
	10	I have to give up too much to do well in this type of Virtual International Collaborative Experiential Program (VICEP).

Procedure

Participation in the survey was voluntary and there was no incentive. However, the first author, who is the initiator of the VICEP, explained the purpose of the survey, the VICEP, and some keywords used in the EVC survey during an information session. This information session included details about the VICEP (logistics, time commitment,

institutional partnerships, projects, and mentoring). There was an opportunity for students to ask questions. An anonymous Qualtrics survey containing all of the aforementioned items was e-mailed to students at the end of the Fall 2020 semester before the launch of the inaugural VICEP program in Spring 2021. The email included a description of the VICEP followed by appropriate Institutional Review Board terminology and language. The collected data were analyzed and the findings are presented below.

Data Analysis

For quantitative data involving the Likert-scaled items from the EVC survey, first, we conducted a confirmatory factor analysis (CFA) using Mplus (Muthén & Muthén, 1998-2017). This allowed us to generate construct validity evidence for the modified instrument and also calculate Cronbach's α coefficients to provide internal consistency reliability evidence. Second, descriptive statistics, such as means and standard deviations, were calculated. Third, as the female student sample size was too small to conduct parametric statistical analysis, we used SPSS (IBM Corp., 2016) to conduct a Mann-Whitney *U* test, a counterpart nonparametric test of independent samples *t*-test (Field, 2009), to check for differences between female and male students on perceptions of expectancy, value, and cost associated with the VICEP program. We also calculated Hedges' *g* effect sizes, correcting estimations for small sample sizes, to present the magnitude of the differences by gender on the perceptions of expectancy, value, and cost (Borenstein, 2009; Hedges, 1981).

For qualitative data on the two open-ended questions about student motivation, the two authors of this study closely examined students' raw responses to supplement details on motivation factors as revealed by the EVC survey of student motivation, namely by using an inductive thematic analysis strategy to identify major themes (Patton, 2002; Thomas, 2006). The examination of the open-ended responses was undertaken in several ways using a conventional content analysis approach (Hsieh & Shannon, 2005). First, the authors independently identified the themes that emerged in the open-ended responses and then independently coded the responses based on their identified themes. Repeated words and keyword groupings were noted and put into preliminary codes. Second, in an initial meeting between the co-authors, the open-ended responses were reread and then each author further refined their coding separately. Then, they held weekly meetings to seek a consensus on their independently identified themes. Third, they once again independently coded the based on the consensus themes, and then compared, discussed, and re-coded until they reached a consensus on all of the coding. Similarities were noted and differences in coding were discussed until each party was satisfied with the changes made. Some codes were integrated with one another to form a sub-theme, while others were removed entirely (Ryan & Bernard, 2003). Finally, they labeled and described the themes and calculated the frequency of each theme appearing in students' open-ended responses. The frequency data were converted to the percentage of students whose responses mentioned each theme (St. Pierre & Jackson, 2014).

Results

Construct Validity and Reliability of the Modified EVC Survey

A CFA using the EVC motivation instrument data from 116 first-year engineering students

revealed that all factor loadings were statistically significant, ranging from 0.723 to 0.947 (See Table 3). All fit indices were in an acceptable fit range, $\chi 2(59) = 2{,}023.6$, $p < .001$, *CFI* = 0.972, *TLI* = 0.961, and Standard Root Mean Square Residual (SRMR) = 0.048, except Root Mean Square Error of Approximation (RMSEA) = 0.122 with 90% confidence interval between 0.092 and 0.153 (Brown, 2015). Factor correlation coefficients among the three factors ranged from -0.400 to 0.834 as shown in Table 4, implying no multicollinearity over 0.850 between constructs (Kline, 2016). The Cronbach's αs ranged from 0.795 to 0.854, with the overall Cronbach's α of 0.844.

Table 3. Parameter Estimates of the CFA Model with Items as listed in Table 2

Construct	Item	Unstandardized Factor Loading (*R*)[b]	SE	Standardized Factor Loading (*R*)[b]	SE
Expectancy	1[a]	1.000	0.000	0.913	0.026
	2	0.856	0.054	0.782	0.044
	3	0.792	0.059	0.723	0.049
Value	4[a]	1.000	0.000	0.811	0.030
	5	1.167	0.047	0.947	0.026
	6	0.921	0.056	0.747	0.042
Cost	7[a]	1.000	0.000	0.767	0.047
	8	1.052	0.085	0.807	0.038
	9	1.151	0.073	0.882	0.032
	10[a]	1.055	0.074	0.809	0.032

Note. [a]The item was used as a marker indicator to scale the latent factor, so the factor loading was set to 1.0 (a constant) and the standard error (*SE*) was set to 0.0, respectively, as no sample estimates were involved, which is the default in Mplus; [b]All 10 factor loadings are statistically significant with $p < .05$.

Table 4. Standardized Factor Correlation Coefficients and Reliability Evidence

Factor	Expectancy	Value	Cost	Cronbach's α
Expectancy	1.000	0.834	-0.369	0.795
Value		1.000	-0.400	0.834
Cost			1.000	0.854

Expectancy-Value-Cost Motivation

The descriptive statistics of students' scores on the EVC survey of student motivation are shown in Table 5. Among the three motivation factors, students had the highest average score on *Value* and the lowest score on *Cost*. In other words, students perceived the high value and low cost associated with the VICEP. The Mann-Whitney *U* tests revealed no significant gender differences in the perceptions of expectancy, value, and cost for the VICEP program.

The Hedges' *g* effect size is close to 0.0, implying no difference in Expectancy between female and male students, in terms of the magnitude of the difference. However, the positive but small Hedges' *g* implies that female students tended to value the VICEP more than male students given the 0.20 magnitude of the difference. In addition, the negative but small Hedges' *g* implies that female students tended to perceive a lower cost for the VICEP than male students with the 0.38 magnitude of the difference.

Table 5. Gender Comparisons on Students' Expectancy-Value-Cost Motivation

Factor	Total (N=116)		Female (*n* = 21)		Male (*n* = 94)		Mann-Whitney *U* Test			Hedges' Test
	M	*SD*	*M*	*SD*	*M*	*SD*	*U*	*z*	*p*	***g***
Expectancy	4.55	0.75	4.52	0.78	4.56	0.76	892.0	-0.70	0.486	-0.05
Value	4.76	0.78	4.89	0.74	4.73	0.79	871.5	-0.85	0.400	0.20
Cost	3.68	1.01	3.36	1.07	3.74	0.99	791.0	-1.42	0.160	-0.38

Factors Associated with Student Motivation

Specific factors that students associated with increased motivation were identified through qualitative analysis of the open-ended survey data. The frequency distribution is shown in Table 6. For each factor, the frequency of a given factor and the corresponding percentage are shown.

Table 6. Factors Increasing Student Motivation

Factor	Definition	*N*	%
Intercultural Collaboration	Working in a multicultural international team, cultural exploration, intercultural learning, and cultural implications in engineering	36	38.3
Learning Opportunity	Opportunity for new learning experiences, learning new concepts, gathering information, and applying knowledge, real experience	18	19.1
Engaged Learning Environment	Hands-on activities using real-life examples, support from peers and faculty	17	18.1
Career Skills Development	Development of skills for the global workforce, resume builder, career preparedness, or networking	16	17.0
Incentives	Extra credit, bonus points, and awards	11	11.7
Structure of the Program	Information about the program curriculum and logistics, partners institutions, project description, and management, support structure, deliverables	11	11.7
Time Commitment	A minimal number of hours on the program each week	6	6.4
Total		94	100.0

Intercultural collaboration was the predominant factor that increased student motivation to participate in the VICEP. Students more often mentioned intercultural collaboration over learning opportunities, engaged learning environments, and career skills development. Looking at the data in Figure 1 from a gender perspective, intercultural collaboration and learning opportunities tend to be more important for female students compared to male students. The quality of the engaged learning environment, impact on career skills development, and incentives tend to be more important for male students compared to female students. About the same proportion of female and male students, 6.3% and 6.4% respectively, mentioned time commitment as a motivating factor.

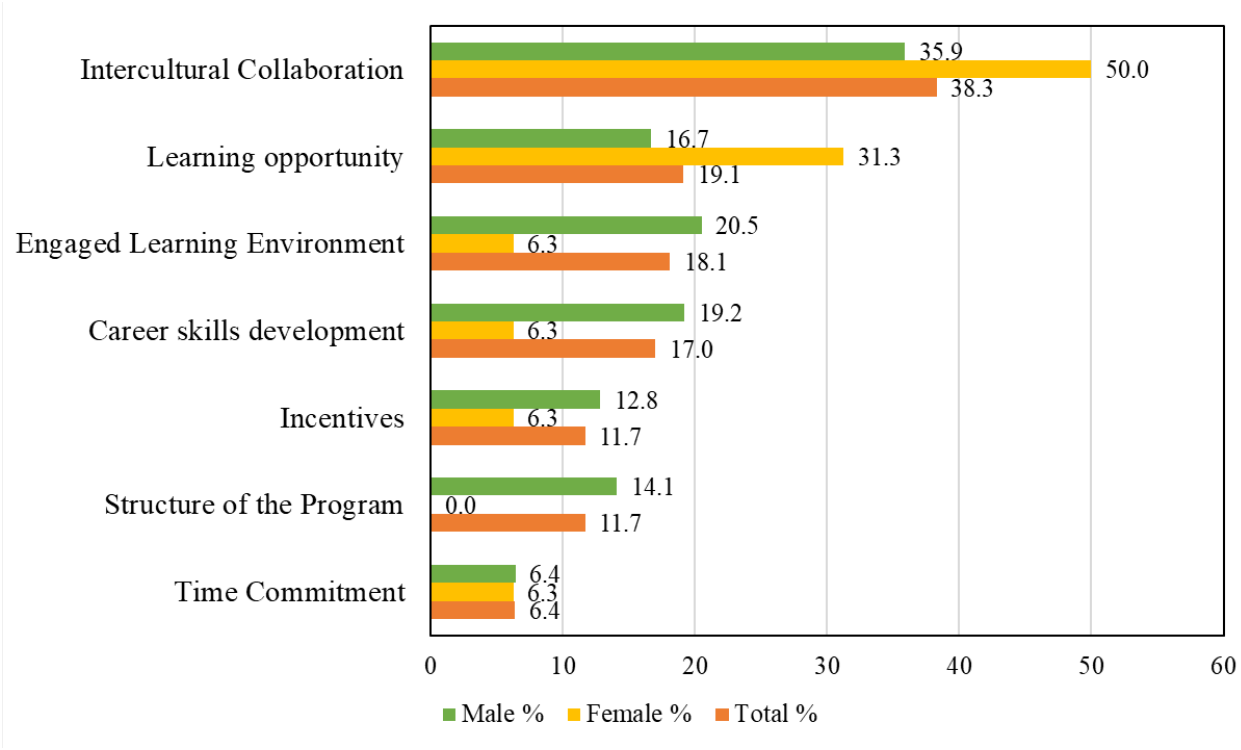

Figure 1. Factors Increasing Student Motivation

Factors associated with decreasing students' motivation were also identified through qualitative analysis of open-ended survey responses, as summarized in Table 7. The time commitment tends to be a major deterrent to motivation (over 60%) for both female and male students. The structure of the program and program-related stress were other important factors decreasing student motivation, with more weight on the structure of the program for female students and on workload-related stress for male students, as shown in Figure 2. The virtual nature of the program was the fourth most commonly mentioned factor, followed by the language barrier. The relevance of the project to students' engineering majors seemed to be the least concern for female students. Concerns about a lack of academic credit were found to be the least important factor for male students.

Table 7. Factors Decreasing Student Motivation

Factor	Definition	*n*	%
Time Commitment	Too much time was needed to complete the project, being overloaded	58	61.1
Structure of the Program	Broad project description and lack of clarity and specific, poorly structured learning support, poorly defined deliverables, and different time zone	19	20.0
Stress	Too much workload, or overworking for extracurricular activities	15	15.8
Being Virtual	Reluctance for online activities and interaction	8	8.4
Language Barrier	Difficulty in communication because of different languages	5	5.3
No relevance	Projects not relevant to students' majors and career	4	4.2
No Incentive	No credit	2	2.1
Total		95	100.0

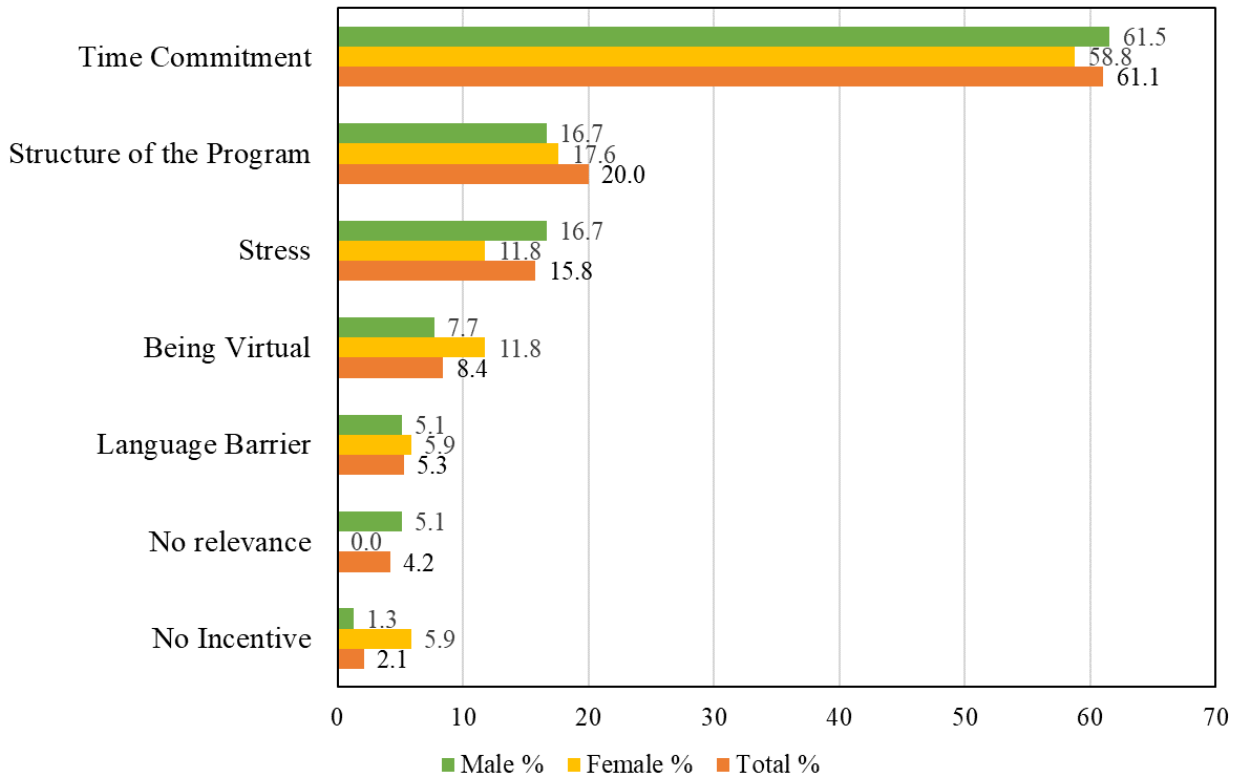

Figure 2. Factors Decreasing Student Motivation

Geographical Preferences for Virtual Collaboration

The geographical preferences of the students for the VICEP program are presented in Table 8. Overall, students preferred Europe the most, followed by South, Central, and North America. China and India were the least favored regions among participants. The trend is similar for both female and male students as the four preferred geographical regions of collaboration for the VICEP were identical. However, female students ranked Sub-Saharan Africa the lowest, followed by China. Male students ranked China and India the lowest. Mann-Whitney *U* tests revealed that there is a significant gender difference in rankings on India, indicating that female students are more favorable than male students toward India as a geographic partner region for the VICEP.

Table 8. Gender Comparisons on the Geographical Preferences for the VICEP

Geographical Region	**Total** (*N* = 116)		**Female** (*n* = 21)			**Male** (*n* = 94)			**Mann-Whitney *U* Test**		
	M	*SD*	*M*	*SD*	Rank	*M*	*SD*	Rank	*U*	*Z*	*P*
Europe	2.98	0.81	3.19	0.68	1	2.95	0.83	1	841.5	-1.14	0.256
South America, Central America, North America	2.85	0.84	3.10	0.94	2	2.82	0.79	2	774.0	-1.67	0.096
Asia and Pacific	2.74	0.87	3.00	0.78	3	2.69	0.88	3	798.0	-1.48	0.139
The Middle East, Northern Africa	2.61	0.91	2.90	0.83	4	2.56	0.91	4	789.5	-1.52	0.129
Sub-Saharan Africa	2.58	0.88	2.76	0.89	7	2.55	0.86	5	855.5	-1.02	0.310
China	2.48	0.91	2.81	0.81	6	2.41	0.92	6	764.5	-1.71	0.088
India	2.40	0.88	2.86	0.85	5	2.31	0.86	7	658.0	-2.52	0.012

Discussion

This paper aimed to understand the factors increasing and/or decreasing first-year engineering students' motivation to engage in a virtual program such as VICEP, as well as their preference for the geographical regions of partner institutions. We discuss in the following paragraphs student motivations for VICEP, the factors affecting their motivation, and their preference for the geographic location of the institutional partners.

Student Motivation

The results from the EVC survey of student motivation revealed that, on average, students had a relatively high expectancy of being successful, a high perception of value for engaging in an experience like the VICEP, and a perception of low cost compared to the expectancy and value average scores. However, the average score of the cost perception, 3.68, was higher than the middle point (3.5) of the Likert scale, which implies that students overall took into consideration cost considerations associated with the VICEP,

such as the time commitment and workload. These findings were consistent with the results from the open-ended questions about factors decreasing student motivation.

Incentives (or the lack thereof), the structure of the program, and time commitment were perceived to be positive factors by some students, but negative factors by others. The virtual nature of VICEP, communication involving a potential language barrier, and a perceived lack of relevance to students' majors were strictly negative factors, albeit to a lesser degree. In sum, the four main factors increasing students' motivations for experiences like the VICEP are listed, in order of preference, as intercultural collaboration, learning opportunities, engaged learning environment, and career skills development. These reasons are similar to what Anderson et al. (2015) found in their study of traditional study abroad experiences, except that instead of an engaged learning environment, students preferred entertainment, such as pleasure and recreation, in the Anderson study.

A comparison of student motivation factors for study abroad programs identified from the literature with our findings based on the EVC motivation theory framework is presented in Table 9. Even though the first two studies, Anderson et al. (2015) and Bandyopadhyay and Bandyopadhyay (2015), were based on traditional study abroad programs, student motivation factors for a virtual program like the VICEP were quite similar. Financial cost was not a factor in the VICEP program.

Table 9. Summary of Factors Affecting Student Motivation for Study Abroad Programs and the VICEP

	Program/Source		
Motivation	Anderson et al. (2015)	Bandyopadhyay & Bandyopadhyay (2015)	Virtual International Collaborative Experiential Program (VICEP)
Expectancy	Personal growth	Personal growth	Learning opportunities
	Entertainment		Engaged learning environment
	World enlightenment	Intercultural awareness	Intercultural collaboration
Value	Career skills development	Career skills development	Career skills development
Cost	Duration & financial cost	Duration & financial cost	Time commitment, virtual nature
Other		General perception	Structure of the program, incentives

Twombly et al. (2012) used a different conceptual framework to discuss students' motivation for traditional study abroad programs similar using Paulsen and St. John's (2002) student choice construct. Twombly et al. (2012) propose that such motivations are

related to various sources of human, economic, social, and cultural capital. Students go abroad for a variety of reasons, including to improve their foreign language skills, gain cultural awareness, enhance future job prospects, or seek pleasure, including as a break from regular coursework or for the sake of adventure (Twombly et al., 2012).

The similarity between Anderson et al. (2015) and Twombly et al. (2012)'s findings regarding entertainment/pleasure, could suggest that adding some social and cultural activities to the VICEP learning environment could be beneficial and help mitigate some factors decreasing student motivation, such as stress, the virtual nature of the program, and time commitment. And just as in traditional study abroad experiences, it is worth underscoring that poorly structured programs will not increase student motivation.

Geographical Preference

We found that students expressed a preference for partners in Europe, the Americas (South America, Central America, and North America), Asia and the Pacific, and the Middle East and Northern Africa as compared to Sub-Saharan Africa and India. These geographical regions have the common attribute of being technologically more developed than India and Sub-Saharan Africa which are among the least preferred geographic regions.

It is further notable that China, despite its relatively high level of technological development, was ranked low in the order of preference. There are two plausible explanations for this. The first is related to language, which is a major factor in decreasing students' motivation. The second is the fact that these data were collected during the COVID-19 pandemic, which was first reported in China. The media coverage of the pandemic and the societal strain due to the stress created by safety measures could have negatively affected students' perceptions. One could also expect that because students indicated that the potential for intercultural collaboration increased their motivation, parts of the globe with large differences in culture, engineering settings, and tourist attractions will be more attractive since they are more likely to ignite students' world enlightenment, personal growth, and entertainment/pleasure, factors which have been ideentified as among students' top reasons for studying abroad (Anderson et al., 2015).

Other relevant insights related to the cultural implications of students' preferred geographic locations were made in Davis and Knight (2021)'s study on the international destinations of traditional study-abroad participants in engineering based on responses to the Global Perspectives Inventory (Braskamp et al., 2014). Based on Hofstede's model of national cultures (Hofstede et al., 2010), they proposed that Australia and New Zealand have a low cultural distance as compared to the U.S.; South Africa and Europe a medium cultural distance; and South America and China a high cultural distance. Even though South America has a high cultural distance in relation to the U.S., similar to China, students preferred these regions in our study (albeit behind Europe), potentially due to their familiarity with or interest in the Spanish language. Our findings, as shown in Table 8, were quite similar to Twombly et al. (2012)'s prior report of preferred geographic locations in traditional study abroad programs: eleven European and seven Spanish-speaking countries in the Americas, along with Australia, Japan, South Africa, India, Israel, and New Zealand, were among the top twenty-five preferred destinations, while

South Africa (1.6 %) and India (1.4 %) were at the bottom.

Gender Differences in Motivation and Preference on Geographical Region

Regarding motivation factors, as shown in Table 5, there were no statistically significant gender differences for all expectancy, value, and cost motivation factors. Particularly, there was no difference in expectancy between female and male students. However, descriptively, female students had a higher perception of the VICEP's value than male students with a 0.20 magnitude of difference. Similarly, female students perceived a lower cost for the VICEP than male students with a 0.38 magnitude of difference. In sum, even though there was no statistical difference in the perceptions of expectancy, value, and cost by gender, female students tended to be more positive about the VICEP program in terms of perceiving greater value and lower cost than male students.

This finding seems to be consistent with the literature in that proportionally more female students have tended to participate in study abroad programs than male students (Bandyopadhyay & Bandyopadhyay, 2015). Lindsay (2014) further found that both female and male students placed equal importance on the biggest perceived barrier or challenge, namely financial cost. In a study of the perceived costs influencing students' motivations for enrollment in a short-term study abroad or experience, Raczkoski (2015) also found that female students had higher scores on Expectancy and Value, while male students had higher scores than female students on Cost. The findings from the literature imply that factors contributing to students' intentions to study abroad are not the same for female and male students. Generally, the reasons provided for female students' higher rates of participation are educated guesses rooted in history and observation. For example, Twombly et al. assert that for "first-year college students, social interactions before and in the first year of college is a predominant factor that discourages men from thinking about study abroad" (2012, p. 52).

Intercultural collaboration, learning opportunities, engaged learning environments, and career skills development were strictly positive factors, albeit with different levels of importance by gender. Female students expressed more engagement in the VICEP principally for the opportunity of intercultural collaboration and learning opportunities than male students. In contrast, male students were more likely to have favorable views of the VICEP based on factors such as a structured learning environment and the potential for positive impacts on career skills development.

For the considered geographical regions, the average interest seems to be higher for female students than for male students. Yet there was a consistency in the preferred destination for both female and male respondents, with the top four most popular regions being Europe, the Americas, Asia and the Pacific, and the Middle East and Northern Africa. There does not seem to be consistency between female and male students in their least preferred regions. Female students' least preferred regions were Sub-Saharan Africa, China, and India, and for male students the least favored regions were India, China, and Sub-Saharan Africa.

Limitations of the Study and Suggestions for Future Research

Through the design of the survey and data cleaning, the authors tried to reduce threats to

the validity of the results. Still, the results of this study must be viewed along with the limitations that are inherent in all studies based on self-reported surveys. Further research could involve an expansion of demographic data collection, such as students' race/ethnicity, first-generation status as an indicator of their socioeconomic status, prior travel or living experiences in other cultures as a possible moderator of student motivation, and additional university affiliations.

The pilot of the VICEP in spring 2021 included student participants at the University of Cincinnati. The post-VICEP feedback is not included in this research. Further investigation into the transformative impact of the VICEP is recommended. In particular, transformative learning is a major outcome of study abroad programs, so it would be meaningful to analyze how programs like the VICEP can encourage transformative learning and what components of the VICEP seem most effective at supporting such learning.

Additionally, the Cost construct in the EVC instrument was focused on time and did not include other dimensions of cost potentially perceived by students, such as overly high effort or workload demands, the loss of valuable alternative experiences, or negative psychological outcomes like stress. This is a limitation that can be corrected in future work by using or developing an instrument that measures other dimensions of Cost.

Conclusion

The findings of this paper support the diversification of global preparedness program offerings in colleges of engineering in terms of cross-cultural exposure and virtual international program design. Understanding student motivation and preference for particular geographic regions can guide practitioners in structuring programs like the VICEP for optimal student participation and outcomes. In addition, given the virtual nature of this program, this approach could be extended beyond the COVID-19 era to alleviate shortcomings of traditional study abroad programs, such as safety, financial burden, and time commitment.

Further, we recommend that program administrators consider the geographic location of institutional partners for programs like the VICEP and highlight the key features (especially for less popular regions) that contribute to intercultural collaboration, learning opportunities, engaged learning environments, and career skills development. Intentionally designed programs with clear goals and a manageable workload to reduce time commitment and stress are also likely to motivate students. Interestingly, the need for incentives (e.g., bonus points, course credit, etc.) appears not to be necessary; however, structuring experiences as stand-alone courses rather than an extracurricular activity (as was the case for VICEP) could help mitigate student concerns related to time commitment and stress.

As companies continue to develop more virtual global teams, virtual experiences will also provide an experience that will provide transferrable skills for the workplace. As Lipinski argues, "It is also expected that the virtual study abroad experience will engage students and encourage them to seek out the opportunity to engage in a live study abroad

experience" (2014, p. 112). Future research should consider how traditional factors shaping male and female students' decisions to participate in study abroad programs apply to programs of with a virtual format (Salisbury et al., 2009; 2010; 2011), such as the VICEP.

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