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The Impact of International Virtual Exchange on Student Success

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ABSTRACT

This study expands the literature on high impact practices by assessing the effect of global experiences, including international virtual exchange (IVE) and study abroad, on student success, measured as GPA, first-year retention, and graduation rate. Our dataset tracks over 47,000 students over 10 years at a large U.S. university. Our fixed effects models show that IVE and studying abroad increase average GPA. Using logit models, we find that taking IVE courses or studying abroad positively impacts the probability students are retained and eventually graduate. Our findings also show that first-generation college students, financially disadvantaged students, female students, and Black and African American students who take IVE courses benefit more than their demographic counterparts who don't. Taken together, these results confirm that IVE is both a high impact practice and a pedagogy that offers significant benefits to under-resourced

students and students who have historically been underrepresented in global learning activities.

Keywords: international virtual exchange, study abroad, student success metrics

High impact educational practices have been identified by the American Association of Colleges & Universities, among others, as providing significant educational benefits to students who participate in them. Global learning and collaborative projects are regularly identified as high impact practices. (Association of American Colleges and Universities, n.d.) These two practices are common elements of International Virtual Exchange (IVE) as described by O'Dowd (2018). For the purposes of this research, we define IVE as technology mediated international experiences that are peer driven, facilitated, collaborative and sustained over time among geographically separated cultural groups. In this study we examine whether IVE is indeed a high impact practice that benefits students.

At our large, comprehensive American university, IVE has constituted a major portion of the university's comprehensive internationalization strategy for nearly two decades. As a university with relatively few international students and, until recently, few students participating in global experiences abroad, IVE represented the most accessible pathway for high impact interactions with persons of a different culture. The university's investment in IVE was initially seen as a means of building cultural awareness particularly among the 98% of students who did not study abroad. Over time the goals of IVE evolved from creating opportunities for cultural interactions to more active skillset development including improving intercultural communication and critical thinking through cross-country, cross-cultural discussions, and collaborative projects. These enhanced practices improved the experiences of the students who are traditionally underrepresented in study abroad by providing opportunities to meaningfully engage internationally and build an appreciation for cultural differences.

The suite of IVE courses offered at the university are called Global Understanding (GU). These courses use what we refer to as the Core Curriculum Model of IVE. This model most closely resembles the Stevens Initiative Program Administration Type II, in which "a single virtual exchange program is run mostly the same way across several sites." (Stevens Initiative, 2020) When collaborating with their international partners, all classes participating in GU courses follow the same flexible structure that we refer to as the Core Curriculum. The majority of GU courses receive both Global Diversity credit and General Education credit for either Social Sciences or Humanities. As implemented at our university, students work with peers from typically three partner institutions consecutively over the semester for a total of approximately 18 hours of synchronous connection and additional asynchronous work on collaborative projects.

In these courses students develop cultural awareness and cultural competencies by synchronously connecting students in different countries for peer-led facilitated discussions and working together on projects. Typically, these

courses fulfill global diversity requirements within the general education curriculum. Students at the university are connected through their IVE courses to students in partner countries to collaborate on assigned projects and discuss a variety of topics while working together to overcome logistical barriers and cultural differences. The university has been offering IVE courses since 2004. Each year, 30-40 IVE courses are offered which connect over 400 university students to their peers around the world. In 2016 the university received the NAFSA Senator Paul Simon Spotlight Award for Campus Internationalization for its work in this area.

This study uses 12-years of data that tracks nearly 50,000 students' participation in globalization experiences and academic performance over their time at the university. We applied advanced statistical analysis of these data to investigate the impacts of IVE on student success metrics. While study abroad is commonly cited as a high impact educational practice, less work has been done on examining whether IVE falls into this pedagogical category. The results of this study demonstrate that universities can enhance student learning and academic performance through IVE and thus establishes that IVE courses are also impactful global learning practices.

LITERATURE REVIEW

High Impact Practices

To improve student retention and engagement, many universities have implemented high impact practices (HIPs) such as first-year experiences, learning communities, writing intensive courses, collaborative projects, research, diversity and global learning, capstone courses, and experiential learning activities. These practices enhance "deep approaches" to learning and critical thinking (Kuh and Schnieder, 2008). Gonyea et al. (2008) found that engagement in these activities had positive results on grades as well as increased persistence in obtaining degrees. Brownell and Swaner (2008) summarize several research projects that find positive impacts of first-year experiences, learning communities, research, and service learning on student persistence and grade point averages (GPAs).[1] As a result of the body of research supporting the merits of these types of practices they have been broadly adopted at U.S. universities.

Study Abroad

[1] GPA is a common metric for academic performance in the United States. It represents performance in classes; numeric scores are assigned for each class where 4 is associated with the best academic performances and 0 is failing. GPA is an average across all courses. The scale used to calculate GPA at this university is calculated as A as 4.0 quality points; A- as 3.7; B+ as 3.3; B as 3.0, B- as 2.7; C+ as 2.3; C as 2.0; C- as 1.7; D+ as 1.3; D as 1.0; D- as 0.7; and F as 0.

This study focuses on the HIP of global learning, which is often taken to mean study abroad. Kuh and Kinzie (2018) assert that studying abroad is "transformative and life changing" for undergraduates. These transformations can be quantified in terms of improved critical thinking skills, cognitive development (Gurin et al. 2002; Pascarella et al. 2014) and enhanced intercultural competency (Salisbury et al. 2013). Salisbury (2013) also found that studying abroad provided educational benefits regardless of the student's background, educational aspirations, or college experiences.

Other studies of students from U.S. universities studying abroad confirm positive academic outcomes upon returning to campus. Bhatt et al., 2021 found study abroad improves 4- to 6-year graduation rates and GPAs at graduation for students across 35 universities confirming Xu's (2004) results for a single university. Several other studies found that study abroad experiences positively affected student's GPA upon returning to campus including Ingraham and Peterson, 2004; Holoviak, 2009; McMahan, 2015; and Whatley and Canché, 2020. Recent evidence of the link between academic performance and GPA have been mixed for European universities, however. For U.K. students, Cardwell (2020) found a positive impact on GPA while Nwosu (2021) found a negative impact. At Limerick University, there was no significant impact of study abroad on student performance (Cullinan et al., 2021).

Similar to this literature, our study also uses data from a single university to examine impacts of study abroad on academic performance, as measured by GPA, upon students' return to campus. Our approach is informed by this research; however, we modify previous work by adding retention rates and graduation rates as dependent variables. More importantly, we conduct similar analysis for other forms of global learning, including IVE and foreign language studies.

International Virtual Exchange

While study abroad is often synonymous with 'global learning,' other internationally focused practices are gaining momentum and acceptance across the higher education landscape. IVE is an international education modality that focuses on online intercultural interaction among geographically separated students and instructors. IVE includes peer-to-peer interaction through facilitated dialogue and collaboration that is generally embedded into academic courses and sustained over time. (O'Dowd, 2018) IVE leverages technology to allow students to engage and collaborate with peers from across the world without travelling abroad. Prior to the COVID-19 pandemic IVE had been practiced only at a moderate scale, but with travel being curtailed by the pandemic, awareness, interest in, and implementation of IVE increased. The Stevens Initiative in their 2021 Survey of the Virtual Exchange Field found that 69% of respondents indicated that their participation in virtual exchange expanded because of the pandemic.

Few studies have quantified the benefits of IVE using a dataset beyond a single IVE experience. Notable exceptions such as Rienties et al.'s (2020) investigation into the impact of virtual exchange on foreign language competence

and Commander, Schloer, and Cushing's study examining the impact of IVE on the development of intercultural effectiveness (2022) in which they sampled students across eight courses. Baroni, et al. (2019) investigated the impact of virtual exchange on teacher education. Other research has documented the effectiveness of IVE by applying qualitative analyses to case studies (Baroni et al., 2019; O'Dowd, 2021). Our study builds on this literature by expanding the metrics of success to include GPA, retention rates, and graduation rates. These metrics are commonly used for institutional effectiveness and student success studies.

Foreign Language Study

Another way of introducing students to different cultures, experiences and perspectives is through foreign language studies. As of 2016, 7.5% of university students in the US were enrolled in a foreign language course (Looney and Lusin, 2019). However, for many students, particularly those with limited financial resources, little or no access to virtual exchange programming, and limited exposure to international students, courses in foreign language and culture may be their most accessible form of diversity/global learning. Numerous studies have shown that foreign language instruction boosts academic achievement, leads to advances in cognitive development, helps students develop cultural sensitivity and an appreciation of globalization (Cooper, et. al, 2008, Wiley, 1985, ACTFL, n.d.). However, there appears to be little research showing that foreign language study leads to improve student success metrics such as GPA. We include foreign language study in this research since it fits the definition of global learning and serves as a reliability check against the other treatments.

A significant contribution of this research is related to the longevity of the IVE program at the university, which was developed nearly two decades ago to close equity gaps in international experiences and exposure to cultural and global diversity. Due to the robustness of the dataset, we can effectively quantify the long run impacts of IVE, and other treatments. The large sample size also allows us to test how the impacts of IVE, and other treatments, differ among those of various socioeconomic and demographic groups. This is particularly important in an era of renewed emphasis on equity and inclusion in American higher education, which has not historically been the hallmark of international education in the US. Our findings indicate IVE is both effective in improving student success generally, and its impacts reach students who are typically underserved by other global experiences.

METHOD

Theoretical Framework

The link between engaging in a particular curricular or co-curricular activity and academic success one, two or several semesters removed from the activity can be viewed through the lens of at least two distinct theoretical frameworks.

Mezirow's (1978) Transformative Learning Theory hypothesizes that individuals can fundamentally transform their self-perception, worldview, and behavior by developing an acute awareness of their unconscious beliefs, values, and perspectives through engaging in task or problem-based learning combined with critical reflection. According to this theory the permanent changes developed through transformative experiences continue to impact how individuals navigate the world around them. By introducing experiences, such as study abroad and IVE, where those underlying values and beliefs that are typically taken for granted are challenged through their engagement with novel environments and others with differing values and beliefs, students are provided the opportunity for transformative learning.

David Kolb's (1984) Experiential Learning Theory hypothesizes that the most impactful method of learning is through active experiences. According to Kolb there is a four-stage cycle to experiential learning: the concrete experience, reflection on that experience, thinking about that experience to understand the meaning associated with it, and then acting or using that experience to influence behavior or thought moving forward. Either of these frameworks are consistent with a strong and persistent impact from the types of activities that are associated with study abroad participation and IVE. Foreign language learning may or may not generate the type of experience necessary to stimulate the persistent improvement in academic performance.

Data

The data used for this study consists of a panel of students at our university from the Fall 2008 semester until the Fall 2020 semester. The dataset begins with new freshman and transfer students entering in the Fall 2008 semester, and new students are added to the sample as they enroll in subsequent semesters. Likewise, students leave the sample upon graduation or termination of enrollment. Overall, the sample consists of 365,424 observations of 47,127 students enrolled at the university between 2008 and 2020. Importantly, the data contain a unique longitudinal identifier for each student allowing us to track students over time as they complete study abroad, IVE, or foreign language courses. This feature of the data is crucial for our identification strategy which relies on estimating the change in average GPA in semesters after completion of a treatment in comparison to a control group.

Empirical Model

To assess the impact of IVE courses on student success at the university we investigate three statistical relationships:

a) the relationship between whether a student took an IVE course and their subsequent grade point average (GPA),
b) the relationship between whether a student took an IVE course and the likelihood they are retained the subsequent year (retention), and

c) the relationship between whether a student took an IVE course and the likelihood they graduate from the university within five years (graduation).

For comparison purposes we include the impacts of participating in two related learning activities, (1) participating in study abroad and (2) taking a foreign language course, on these same student success measures. While virtual exchange at the university is described in detail in previous sections of this paper, the intuitional context for the other two treatments has not previously been discussed. Study abroad enters our analysis as a dichotomous treatment variable. The study abroad treatment consists of both short-term credit-bearing summer programs led by university faculty *and* semester exchange programs with partner universities abroad. The foreign language treatment, which also enters the model as a dichotomous variable, consists of any one semester course in a foreign language generally consisting of 45 instructor/student contact hours during the semester. Statistically significant results for any of these three activities, or 'treatments,' would confirm that they are high impact practices, that is they confer significant educational outcomes by improving measurable student success measures.

Grade Point Average

To estimate the impact of the treatment on subsequent semesters' GPA, we first estimate the following student fixed-effects model:

$$GPA_{i,t}=a+\beta_1*IVE_{i,t}+\beta_2*Abroad_{i,t}+\beta_3*For\_Lang_{i,t}+Maj_{i,t}*\delta+I_i+T_t+\varepsilon_{i,t} \quad (1)$$

In equation (1), $GPA_{i,t}$ is the outcome measuring the semester GPA, where i represents an individual student and t represents time (semester). The variable $IVE_{i,t}$ is a 0/1 indicator that is 0 when a student has not had an IVE course, and switches to a 1 in the semester a student takes IVE and remains equal to 1 every semester thereafter. Likewise, $Abroad_{i,t}$ and $For\_Lang_{i,t}$ are indicator variables for study abroad and foreign language participation; 0 without these treatments and 1 during and after the treatments. Note that the treatment variables of interest measuring participation in virtual exchange, study abroad, and foreign language are not mutually exclusive. In other words, it is possible for more than one indicator variable to equal 1 simultaneously for students participating in more than one international activity.[2] Equation (1) also includes indicator variables for the declared major of the student ($Maj_{i,t}$), individual student (I_i) and semester (T_t) fixed effects to control for unobservable student characteristics that do not change over time and semester-specific aggregate time-trends in student GPA change. The coefficients β_1, β_2, and β_3 represent the changes in GPA after engaging in

[2] Roughly, 12% of IVE participants also participate in study abroad. Foreign language courses are more ubiquitous with roughly 35% of IVE participants and 40% of study abroad participants also completing a foreign language course.

each of the treatment activities, virtual exchange, study abroad, and foreign language, respectively. The random error term is included as $\varepsilon_{i,t}$.

The statistical estimation strategy shown in equation (1) is reasonable so long as there are not differences in the pre-treatment time trends for students who select to participate in the treatment activities compared to those who do not as illustrated in Figure 1. However, if the types of students who select to participate in one or more of these programs have differential time trends in GPA relative to average non-participants, the results from equation (1) would yield biased treatment effects as illustrated in Figure 2. To mitigate possible bias, we select a control set of students to incorporate into our fixed-effects estimation strategy who are similar to those receiving the treatment in observable characteristics but did not participate. By pre-processing the data using matching we construct a control group that is more likely to satisfy the parallel trends assumption. This allows us to rule out differences in observable characteristics as a cause of the change in GPA. The only possibility for the change in GPA is because of the treatment or some other confounding factor we cannot observe.

We construct a balanced matched sample of control observations for each of the three treatments comprised of students who share similar characteristics based on their observed demographics. Specifically, for each of the programs, we first require an exact match in terms of semester of university matriculation to ensure that we compare program participants with non-participants who begin their studies at the same starting point. We then separately estimate the propensity for participating in one of the programs using logit models where participation is modeled as a function of demographic attributes (race, ethnicity, gender citizenship, and state residency status) academic attributes (high school GPA, college entrance exam Scholastic Aptitude Test (SAT) score, and honors college designation), socioeconomic attributes factors (first-generation college students and recipients of needs-based grant aid (Pell recipients)) and extra-curricular designations that draw on students' time (student athletes and participation in social organizations designated as fraternity/sorority membership). Finally, for each program participant we choose 3 matched non-participating control students who are most similar in terms of their predicted propensity to engage in that activity.

After constructing our balanced matched sample of controls, we estimate the following student fixed-effects model:

$$GPA_{i,t}=a+\beta_1*IVE_{i,t}+\beta_2*Abroad_{i,t}+\beta_3*For\_Lang_{i,t}+Maj_{i,t}*\delta+I_i+T_t*G_i+\varepsilon_{i,t} \quad (2)$$

where all variables are defined as in equation (1) with the exception that our semester time trends, T_t, are now interacted with a group of indicator variables, G_i, indicating whether each observation belongs to one or more of three exhaustive groups. The first G_i group consists of IVE participants and their matched controls, the second group consists of study abroad participants and their matched controls, and finally, the third group is composed of students taking

foreign language courses and their matched cohort of nonparticipants.[3] In sum, equation (2) is similar to that of equation (1) in that it is based on within-student changes in GPA over time, but it differs in terms of the estimating sample. Instead of using the full dataset, this technique uses only the matched treatment and control groups.

We next explore the possibility of treatment effect heterogeneity of program participation using the preferred matched sample technique (equation 2). Specifically, we estimate whether different demographic and socioeconomic groups experienced differential impacts in terms of GPA from participation in these programs. To explore the possibility of heterogeneous treatment effects, we modify equation (2) to include interaction terms with our demographic and socioeconomic groups as follows:

$$GPA_{i,t} = a+\beta_1*IVE_{i,t}*X_i+\beta_2*Abroad_{i,t}*X_i+\beta_3*For\_Lang_{i,t}*X_i+Maj_{i,t}*\delta+I_i+T_t*G_i +\varepsilon_{i,t} \quad (3)$$

Where X_i is a vector of variables measuring first generation college students, Pell recipients, race/ethnicity, citizenship status, gender, and income status of the student's county of origin, lowest income/most distressed counties are Tier 1 in a 3-tier designation system. For example, in equation (3) we can estimate separate treatment effects for Pell recipients and non-recipients based on the estimated coefficient of the interaction of indicators for these groups with our high impact program of interest (IVE, study abroad, foreign language). In total, six models are separately estimated to control for each of the previously mentioned demographic and socioeconomic characteristics. The remaining variables in equation (3) are as defined in equation (2) above.

Retention and Graduation Rates

A different model must be used to estimate the impact of virtual exchange, study abroad and foreign language participation on graduation and retention rates, which are two other commonly used alternative measures of student success and

[3] As noted in the main text and footnote 5 many students participate in more than one international activity. The pre-processing of the data first matched all IVE participants to 3 nearest neighbor control observations who did not participate in any of the IVE, study abroad, or foreign language activities. We then repeated the matching algorithm for the remaining study abroad participants (i.e., those not taking IVE), and finally we matched the remaining foreign language participants who did not take IVE or study abroad to 3 controls. We matched IVE participants first, because 75% of the individuals participating in IVE and study abroad took their IVE classes before spending a semester abroad. The matching was done with replacement, so the matched controls may serve as control observations for more than one treatment observation and group. This allows to control for the possibility of heterogenous time-trends across the three groups.

institutional effectiveness. Here we estimate the change in the probability of graduating (or being retained) using the following logit model:

$$P(y=1|X, IVE, abroad, For\_Lang) = \frac{\exp(X*\gamma+\beta_1*IVE_i+\beta_2*Abroad_i+\beta_3*For\_lang_i)}{1+\exp(X*\gamma+\beta_1*IVE_i+\beta_2*Abroad_i+\beta_3*For\_Lang_i)} \quad (4)$$

where *y* is an indicator variable equal to 1 for successful completion of our outcome of interest (i.e., graduation or first-to-second year retention) and equal to zero otherwise. The vector *X* includes controls for all of our observable demographic and socioeconomic characteristics along with indicator variables for major at time of matriculation. Finally, we include our controls of interest measuring participation in IVE, Abroad and For_Lang. Notice that the time subscripts have now been dropped from the indicator variables for IVE, Abroad, and For_Lang participation as these variables are now equal to 1 for students who participate in these programs during any point in their college studies (graduation) or equal to 1 for students who participate in the respective programs during their freshman year (retention).

With the earlier GPA analysis, we have multiple observations for each individual student before and after the treatment, which allows us to rely on within-student changes to determine the impact of the treatment. However, in estimating the impact of the treatments on whether students successfully graduate (or are retained after one year) we can no longer rely on within-student changes and we must collapse the longitudinal data we had in equations 1 and 2 to a cross-section of one observation per student.[4] Our estimates of the impact of the treatment on retention and graduate rate may be subject to the selection bias. Thus, a careful interpretation of our results is that the positive sign on the coefficients on study abroad and IVE in the retention and graduate equations confirms benefits to these two global experiences on student success metrics.

RESULTS

Descriptive Statistics

Summary statistics for the full and matched samples are presented in Table 1. Columns 1-3 show the summary statistics for the IVE, Abroad, and For_Lang treatment groups, respectively. Columns 4 and 5-7 present the summary statistics for two alternative counterfactual groups. Column 4 consists of all possible control students who never enroll in IVE, Abroad, or For_Lang, and Columns 5-7 consists of a subset of these students who closely match observations in the treatment groups based on their demographic characteristics but who never participated in these activities.

[4] Note that in the matched sample when we collapse to a cross-section there may be repeat observations for control students since matching was done with replacement.

Table 1. Summary Statistics

	Mean (Std. Deviation)						
Variable Name	IVE	Abroad	For_ Lang	All Ctrls	IVE Ctrls	Abroad Ctrls	For_ Lang Ctrls
Semester GPA	3.002 (0.812)	3.300 (0.669)	2.962 (0.827)	2.968 (0.852)	3.024 (0.846)	3.130 (0.799)	2.996 (0.855)
On Campus Resident	0.289 (0.453)	0.243 (0.429)	0.282 (0.450)	0.296 (0.457)	0.297 (0.457)	0.272 (0.445)	0.289 (0.453)
1st Gen College Student	0.170 (0.375)	0.115 (0.319)	0.176 (0.380)	0.162 (0.368)	0.159 (0.365)	0.104 (0.305)	0.166 (0.373)
Pell Grnt Rcpt.	0.445 (0.497)	0.309 (0.462)	0.457 (0.498)	0.388 (0.487)	0.466 (0.499)	0.347 (0.476)	0.457 (0.498)
Student Athlete	0.0490 (0.216)	0.0140 (0.117)	0.0290 (0.168)	0.0318 (0.176)	0.0457 (0.209)	0.0154 (0.123)	0.0335 (0.180)
Frat/ Sorority	0.198 (0.399)	0.308 (0.462)	0.204 (0.403)	0.225 (0.417)	0.233 (0.423)	0.356 (0.479)	0.238 (0.426)
Honors Student	0.038 (0.191)	0.120 (0.325)	0.0399 (0.196)	0.0247 (0.155)	0.0661 (0.248)	0.124 (0.330)	0.0491 (0.216)
White	0.608 (0.488)	0.756 (0.429)	0.630 (0.483)	0.716 (0.451)	0.599 (0.490)	0.745 (0.436)	0.634 (0.482)
African Am.	0.215 (0.411)	0.0908 (0.287)	0.200 (0.400)	0.146 (0.353)	0.221 (0.415)	0.0973 (0.296)	0.197 (0.398)
Hispanic	0.0578 (0.233)	0.0560 (0.230)	0.0601 (0.238)	0.0484 (0.215)	0.0599 (0.237)	0.0597 (0.237)	0.0610 (0.239)
Male	0.341 (0.474)	0.237 (0.425)	0.336 (0.472)	0.438 (0.496)	0.297 (0.457)	0.215 (0.411)	0.312 (0.463)
Non-citizen	0.0193 (0.138)	0.0108 (0.103)	0.0117 (0.108)	0.0110 (0.104)	0.0158 (0.125)	0.0123 (0.110)	0.0118 (0.108)
H.S. GPA	3.667 (0.516)	3.789 (0.596)	3.642 (0.518)	3.676 (0.517)	3.742 (0.525)	3.822 (0.542)	3.700 (0.525)
SAT Score	1,039 (117.9)	1,077 (127.6)	1,051 (120.0)	1,038 (115.2)	1,053 (121.3)	1,080 (124.6)	1,054 (119.9)
Tier 1 County	0.182 (0.386)	0.120 (0.325)	0.175 (0.380)	0.198 (0.399)	0.215 (0.411)	0.184 (0.387)	0.206 (0.404)
Tier 2 County	0.285 (0.452)	0.260 (0.439)	0.280 (0.449)	0.276 (0.447)	0.269 (0.443)	0.267 (0.442)	0.270 (0.444)
Out-of-state	0.133 (0.340)	0.210 (0.407)	0.142 (0.349)	0.138 (0.345)	0.136 (0.343)	0.149 (0.356)	0.139 (0.345)
# of Obs	28,822	31,585	76,681	253,151	128,141	116,851	207,393
# of Students	3,250	3,218	8,828	34,422	7,824	6,374	13,882

As shown in columns 1-4 of Table 1, we see a higher average semester GPA among Abroad participants (3.307) and a slightly higher GPA among IVE participants (3.002) in comparison to non-participants (2.968). For_Lang participants have a slightly lower GPA at 2.962 on average. However, interpreting these differences in average GPA between treatment and control groups as the effect of participation in international activities on GPA is not accurate, as the data reveal several potentially important confounders associated with the students who select to participate in global curricula. For example, study abroad participants are less likely to be first generation college students or Pell recipients, are more likely to be members of the honors college, and have higher average high school GPA and SAT scores. Each of these factors would be expected to contribute to a higher average GPA among Abroad participants in comparison to the control group. IVE and For_Lang participants are generally more similar to the control group with the exception that these programs tend to attract larger proportions of students of color and female students.

Removing Selection Bias

As a first step toward constructing causal estimates of the impact of global curricula participation on student GPA we remove the potential bias associated with the previously mentioned selection differences based on the observable characteristics reported in Table 1. Specifically, this is accomplished by separately estimating the probabilities of participation in IVE, Abroad, or For_Lang as a function of all the characteristics in Table 1 (except for semester GPA since this is the key outcome of interest). Each IVE, Abroad, and For_Lang participant is matched to 3 control observations who matriculated at the same starting point and who are most similar in terms of their predicted participation probabilities, and by extension their relevant demographic characteristics. Columns 5-7 in Table 1 present summary statistics for our set of matched controls. As previously noted, our program participants in Abroad and IVE tend to have a higher GPA than non-participants in the unmatched sample. The average GPA of the matched non-participants is slightly higher at 3.130 and 3.024, respectively. This difference between the matched and unmatched controls reflects the selection process whereby students choosing to participate in study abroad and IVE tend to have other confounding observable characteristics that are positively correlated with GPA. The substantial differences in the summary statistics between the control group in column 4 and the matched control groups in column 5-7, suggests that a matched control model, as described in equation (2) may be a preferable estimation strategy. Specifically, columns 5-7 illustrate the improved balance among the observable confounders for the matched control groups as the summary statistics for the matched controls are generally comparable to their respective treatment groups.

Matching alone, however, can only remove selection bias associated with observable characteristics. Note, however, that our estimation strategy first pre-processes the data using matching, and then estimates student fixed-effects models on the matched sample. The inclusion of student fixed-effects in equation

(2) also allows us to remove selection bias associated with unobservable student characteristics provided those unobservable confounders are time-invariant. While we cannot eliminate all possible sources of bias, the remaining bias can only be attributed to time-varying unobservable characteristics that are changing in a systematic fashion with our treatments of interest (IVE, study abroad, and foreign language).[5]

Regression Results: Grade Point Average

Results from equation (1) are presented in the first column of Panel A in Table 2. According to these results, after participating in study abroad average student GPA increases by 0.07 points in subsequent semesters. The 95% confidence interval of this impact is between 0.05 to 0.09 points. To put this number in perspective, the estimated treatment effect of 0.07 is equivalent to each student moving up 1/3 of a letter grade (e.g., increasing from a B to a B+) for one course during each semester following participation in study abroad assuming a normal full-time course load of 15 credit hours per semester.

Participation in an IVE course is also estimated to increase student GPA in subsequent semesters, this time by 0.03 points. The positive effect of IVE on GPA is also statistically significant at the 5% level. The point estimate for the impact of IVE on GPA is about half the size of the impact of study abroad. Again, putting this number in perspective, the treatment effect of 0.03 indicates that about half the students taking IVE courses move up 1/3 of a letter grade for one course during subsequent semesters. Finally, the impact of For_Lang participation is statistically indistinguishable from zero at any standard significance level which means there is no evidence that taking a foreign language course improves GPA in subsequent semesters.

Results using our preferred matched sample method, as shown in equation (2), are presented in Panel B of the first column of Table 2. Overall, the results are very similar from the baseline fixed-effects model given in equation (1). Study abroad participation is now estimated to increase subsequent semester GPA by 0.067 points, IVE participation increases GPA by 0.03 points and, again, both of these effects are statistically significant. Using the matched sample, For_Lang is estimated to increase GPA by 0.003 points, but once again this effect is not statistically significant. The similarity between our matched results in Panel B and the baseline model in Panel A suggests that although selection may contribute to different levels of GPA among program participants and non-participants, it does not result in significant differences in time trends of the changes in GPA among these two groups.

[5] For example, we do not have data on membership in international student organizations. If these memberships are correlated with IVE, study abroad, or For_Lang, and also improve student GPA, then their effects are confounded in our estimated treatment effects presented in Table 2.

Table 2. Impact of Global Curricular Activities on GPA, Grad & Retention

Independent Variable	Dependent Variable Estimated Coefficients (Std. Error)		
Panel A: Full Sample	GPA	Graduation	1-Yr. Retention
Study Abroad	0.0708***	1.641***	1.016***
	(0.00810)	(0.0768)	(0.227)
Int'l Virtual Exchange	0.0284**	0.653***	0.234***
	(0.0112)	(0.0550)	(0.0861)
Foreign Language	-0.00426	0.670***	0.155***
	(0.00778)	(0.0372)	(0.0531)
Panel B: Matched Sample			
Study Abroad	0.0670***	1.618***	0.681***
	(0.0103)	(0.0819)	(0.228)
Int'l Virtual Exchange	0.0297**	0.628***	0.128
	(0.0126)	(0.0610)	(0.0887)
Foreign Language	0.00258	0.708***	0.123**
	(0.00838)	(0.0382)	(0.0531)

Statistical Significance at the 10%, 5%, and 1% level are represented by *, **, and ***, respectively.

Note. GPA coefficients can be directly interpreted as the impact of participation in global activities on the average GPA of subsequent semesters. Graduation and retention coefficients are from a logit specification and the sign of these coefficients is indicative of the correlation between participation in global activities and the probability of graduation and retention. Full sample GPA panel results include 365,424 observations of 47,127 students. Matched sample GPA panel results include 398,528 observations of 20,996 students. The graduation and retention samples are cross-sectional and include 1 observation per student. Although not reported, each specification includes student, semester, and degree fixed effects. In addition, the matched results include separate time trends for IVE, study abroad, and foreign language matched groups.

Heterogeneity

An important contribution of this research relies on the techniques being used to illuminate how these three global experiences impact various demographic student groups. The estimates of heterogeneous treatment effects from equation (3) are presented graphically in Figure 3. Point estimates of treatment effects for each group are marked with "x" and the bars represent 95% confidence intervals for these estimates.

We limit our discussion of treatment effect heterogeneity to IVE and study abroad programs since foreign language courses tend to have a negligible impact on GPA across demographic groups as estimated by the overall effects in equation (2). Our point estimates indicate that IVE boosts GPA for several marginalized groups (Black and Hispanic students, first-generation college students, Pell recipients, non-citizens, females, and students from low-income counties).

However, the 95% confidence intervals for program participants belonging to different demographic groups generally overlap suggesting that estimated heterogeneity is not statistically distinguishable from the overall effects already presented in Table 2. There are a few exceptions and patterns of interest that are worth highlighting. For example, female IVE participants experience a roughly 0.06 increase in GPA, while their male counterparts experience a decline in GPA, although this decline is not statistically significant. The effects for male and female students are statistically different from one another.

Regression Results: Graduation/Retention

The results from equation (4) are reported in columns 2 and 3 of Table 2. Panel A displays the results where all students not participating in the programs represent the control group and Panel B displays the results where only the matched sample represents the control group. The estimated signs (+/-) and statistical significance of these coefficients suggest a positive statistically significant effect of all the programs on the probabilities of both graduation and retention, with the one exception of first-year retention effects of IVE in the matched sample are not statistically significant.

As they are, these coefficient estimates are not directly interpretable as magnitudes of the treatment effects. Rather to interpret these effects as the marginal contributions of the treatments, we can calculate the average partial effects of the programs defined as the difference in predicted probabilities of success when all students are assigned to treatment vs. control groups. From Panel A, for example, these average partial effects suggest that IVE, Abroad and For_Lang are associated with a 13, 27, and 13 percentage point increase in the probability of graduation, respectively. Likewise, IVE, Abroad and For_Lang are associated with a 3.1, 11, and 2.1 percentage point increase in the probability of 1-year freshman retention in the full sample. The full set of predicted probabilities and associated average partial effects for the graduation and retention analyses are provided in appendix Table A1. Due to the potential selection bias of these cross-student estimators, the coefficients should not be interpreted strictly as causal effects. Rather, we rely on the positive significant correlations between the international programs and the dependent variables (probability of improving retention and graduations rates) as further robustness evidence of the benefits of study abroad and IVE courses on student performance.

IMPLICATIONS

This research provides a much-needed infusion of empirical analysis into the research on international virtual exchange, particularly as it relates to its status as a high impact educational practice. Using our preferred matched sample approach, we find that taking an IVE course leads to higher average GPA each successive semester after taking the course. IVE course work has a smaller impact relative to study abroad but outperforms foreign language course. While these results may seem tepid on the surface, the second level of analysis breaks down the

effectiveness of programming by student attributes. We find that the greatest impact of IVE on student success is with students who are historically underrepresented in study abroad experiences. Our results suggests that first-generation college students, female students, Black and African American students, Hispanic students, and financially disadvantaged students tend to see the largest improvements in academic outcomes subsequent to participating in an IVE course.

Taking an IVE course increases the likelihood that a given student will graduate from the university. This is also true for study abroad and foreign language courses. Taking study abroad or a foreign language in the first year improves the probability of retention into the second year. While our point estimate of the impact of IVE on retention rate is positive, it is not statistically significant which is likely an artifact of the small number of incoming students who taking IVE courses in their first year. Taken together the major implications of this research are that the university's investments in virtual exchange and study abroad programming have positive impacts on student success measures. Furthermore, these investments in IVE programming have especially large benefits for students who have historically not participated in study abroad courses. As a matter of equity, resources devoted to virtual exchange programming pay substantial dividends for students in historically marginalized and under-resourced groups that have been underrepresented in international curricular experiences.

The results from our analysis provide convincing evidence that IVE is a high impact practice leading to positive changes in student success metrics at the institution investigated. It is important to note, however, that more research is needed to confirm whether these results are universal to IVE more broadly, or whether they are related to the unique model of virtual exchange examined where students collaborate with multiple partners over a full semester with a very high number of synchronous contact hours. Given the variability in the broader field of virtual exchange in terms of both dosage and types of interaction, similar research investigating student success measures in different contexts is warranted. Studies that show IVE not only impacts proximate intercultural learning outcomes, but also higher-level student success metrics are extraordinarily valuable as a part of the narrative that IVE practitioners can use to both gain institutional support for their work and promote IVE in broader strategic plans.

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