

International Education in the 21st Century: The Importance of Faculty in Developing Study Abroad Research Opportunities

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Study abroad participation rates have more than tripled in the past two decades with nearly 289,408 students participating in 2012-13. The Institute of International Education (IIE) has launched its *Generation Study Abroad* initiative, with the goal of doubling the current number of American students participating in education abroad to approximately 600,000 by the year 2017-18 (IIE, 2014). Much of this growth is reflected in short-term programs at the expense of the traditional yearlong study abroad. Despite this growth, only recently have the percentage of students studying the sciences, technology, engineering, and math (STEM) reached levels of participation commensurate with such traditional fields of study as the humanities and the social sciences (Farrugia & Bhandari, 2013). Why have study abroad enrollments in the STEM fields been so slow to expand in desired magnitude(s), especially given the explosion of shorter-term programming and associated marketing efforts? The obvious answers are the strict curricula of STEM majors and a lack of integration of study abroad programs with STEM curricula. It is therefore logical to assume that in order to continue increased participation among STEM students, U.S. colleges and universities will need to better integrate study abroad into the STEM majors.

In their concerted efforts to grow STEM enrollments over the past twelve years, study abroad offices may have failed to recognize that disciplinary interests and motivations of STEM faculty can be different than those teaching in other majors, such as those in the humanities and the social sciences, when it comes to internationalization. This differing STEM faculty orientation, may explain both the lower engagement among these faculty, but also the low numbers of these students studying abroad. Faculty within the STEM disciplines are interested in internationalization primarily as a way to forward the aims of global research with an emphasis on disciplinary and research skill development to solve grand scientific challenges that transcend national borders (Agnew, 2013). This orientation is reflected in higher rates of international research collaborations among U.S. researchers, the growth of direct undergraduate research with faculty on college campuses, and even increases in the numbers of students who are now pursuing these kinds of activities abroad. With this in mind, what kinds of programs might leverage STEM disciplinary research interests to facilitate growth in these majors? More importantly, how would these programs distinguish themselves from traditional ones, which are usually course-based? And finally, how would they incorporate STEM faculty to ensure that they are sufficiently integrated into the curricula? This paper answers these questions and argues for a reimagining of education abroad that fuses short-term programming with some kind of experiential research component led by home campus *disciplinary* faculty, especially those in the STEM fields, in

order to better integrate the study abroad program into the core undergraduate curriculum. To show how this could be done, it 1) provides a brief background on study abroad; 2) reviews the relevant literature on the learning goals, program assessment, and faculty engagement in education abroad programs, 3) examines the current state of academic integration within study abroad, 4) explores the growth in undergraduate research at both home and overseas, and 5) identifies the unique opportunities represented in the extensive patterns of international faculty research collaborations and lays out a path forward how these patterns could be leveraged into new kinds of study abroad programs. The argument is supported with evidence of innovative programs at several American universities.

The Value, Definition, & History of Study Abroad

Scholars point to study abroad as an important component of international education, as well as a university's efforts to "internationalize" (Arum, 1987; Bonfiglio, 1999; Knight, 2003). Recent research validates the high value that study abroad has traditionally enjoyed, such as intercultural learning and global awareness, foreign language acquisition, disciplinary learning, and other positive long-term impacts (Clarke, et al., 2009; Deardorff, 2006; DeGraaf, et al., 2013; Kurt, et al., 2013; Redden, 2010). This paper takes a more expansive definition of study abroad, embracing one that is put forward by the Forum on Education Abroad:

Education that occurs outside the participant's home country. Besides study abroad, examples include such international experiences as work, volunteering, non-credit internships, and directed travel, as long as these programs are driven to a significant degree by learning goals (Forum on Education Abroad).

This definition acknowledges that the complete education abroad experience includes various forms of service learning, internships, and research with faculty (both for-credit and non-credit activities).

Study abroad is highly diversified by location, form, duration, and learning goals. Geographically, programs have sprouted up on disparate parts of the globe, ebbing and flowing in response to not only student demand and cost, but also safety and security (Ogden, Soneson, & Weting, 2010). Since its modern inception after World War I, the junior year abroad (JYA) served as the hallmark of the study abroad experience, along with the faculty-led tour (Hoffa, 2007).¹ For instance, New York University held a course in Cologne, Germany as early as 1914, and began a series of summer faculty-led courses in the 1920s in England, France, Germany, and Italy. After World War II, and during the Cold War, colleges and universities used foundation and government money to create largely classroom based (and often foreign language centric) direct enrollment/immersion and long-term programming (Rodman and Merrill, 2010). One example of this growth is the establishment of the University of California's Education Abroad Program (UCEAP) in 1962, a consortium design to serve all UC campuses. In the late 1960s and 70s, humanities and social sciences departments not only began to increase the international content within their majors, but also introduced new international studies majors and minors in the 1980s, which encouraged further growth (DeWinter and Rumbley, 2010).

¹ Spear-headed by the University of Delaware, Smith College, Rosary College, Montclair Teachers College and others, the first formal fall to spring semester programs began in the 1920s and continued until the outbreak of World War II.

Since that time, study abroad has expanded into almost every major found on typical U.S. college campuses. Although social sciences and business dominate study abroad programs, the STEM majors have made up much ground in recent years at the expense of the humanities, as can be seen in the chart below.

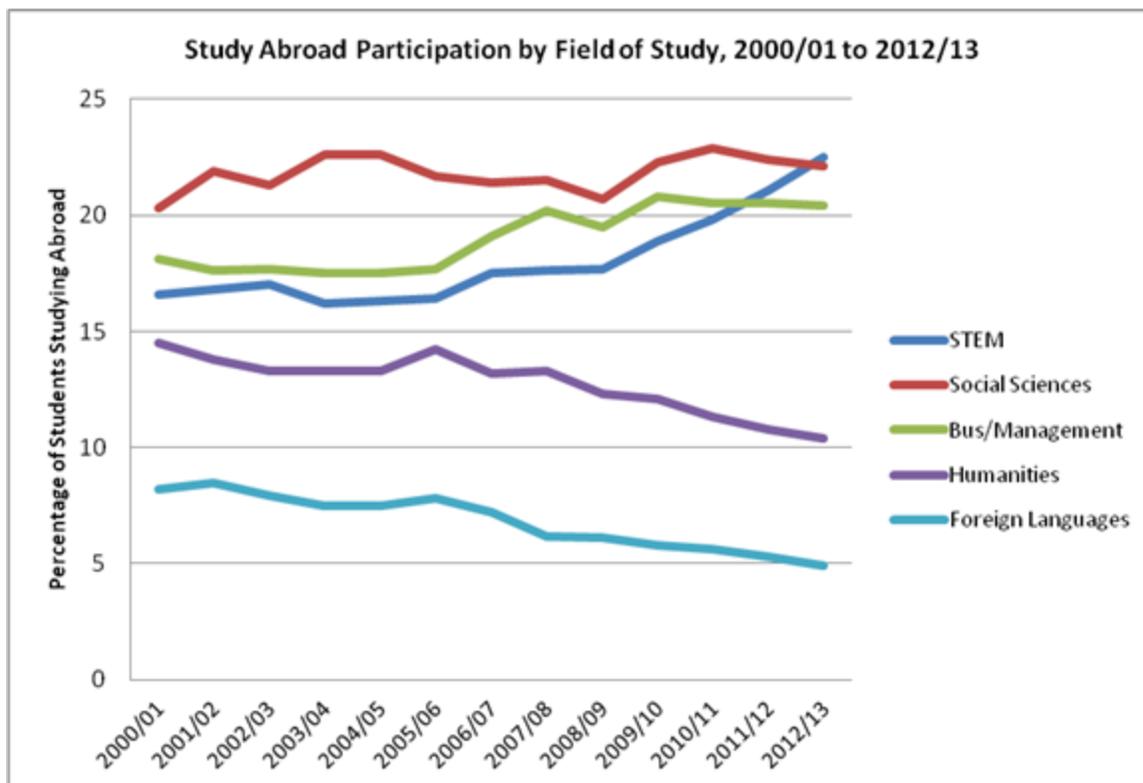


Figure 1: Study Abroad Participation by Major, 2000/01 – 2012/13; Source: Institute of International Education, Open Doors (2014).

What has emerged today is an ever-enlarging set of diverse semester immersion programs (including direct-enrollment); excursion- and study center-based, consortia-based, faculty-led programs; summer and winter programs; multi-site programs; numerous forms of service learning programs (e.g., internships, volunteerism, and field work), and even so-called “academic tourism” (Engle & Engle, 2003). However, short-term programming (less than one semester or two quarters) predominates over other program types, as they accounted for 62% of all participants in 2012-13, as the figure below illustrates (IIE, 2014).² Many of these short-term programs are either ‘island programs’ or faculty-led programs and are usually taught in English with some foreign language component.

² Similarly, programs lasting eight weeks or less during the academic year increased from 8% in 2004-05 to over 14% in 2011-12.

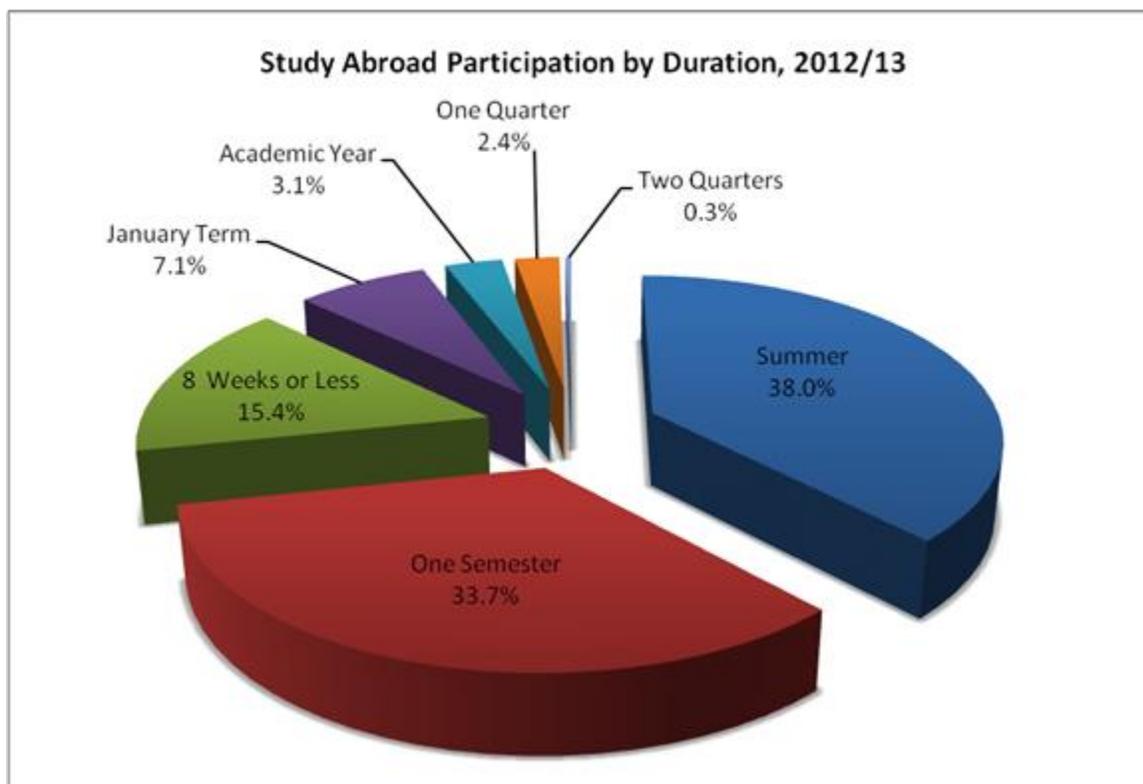


Figure 2: Study Abroad Programs by Duration, 2012/13; Source: Institute of International Education, Open Doors (2014).

In tandem with the growth in program participation, study abroad offices have also tried to better integrate their programs into the local undergraduate curricula. Academic integration can be simply defined as the incorporation of a program into a major to increase the amount of academic credit from courses taken abroad that count towards major, minor, or even general education requirements. The most influential model of academic integration is the “Curricular Integration” initiative undertaken at the University of Minnesota (UMN) from the mid-1990s to the early 2000s. Through the application of an “Assess-Match-Motivate” model, UMN not only paired a number of programs to academic departments, but also identified learning outcomes for specified majors. In doing so, it paid particular attention to faculty engagement (Shirley & Gladding, 2005). Findings indicated that the initiative resulted in an increased faculty engagement with study abroad programming (Woodruff, 2009). Other important factors central to success in academic integration includes academic advising, institutional support, and scholarships (Fernández-Giménez, et al., 2005; Fernández-Giménez and Allen, 2005). A number of other institutions subsequently modeled their own integration programs on the UMN initiative, including Oregon State University, the University of Wisconsin at Eau Claire, Skidmore College, the University of California at San Diego, and Michigan State University (Van Deusen, 2007). Since the mid-2000s, study abroad offices have continued to make incremental gains in integrating their programs. Indeed, many island programs are primed to be academically integrated, especially if the institution’s own faculty teach the courses offered. However, these programs are designed to appeal to a fairly large swath of majors – in most cases political science, history, sociology, development studies, etc. It is fair to say that the faculty-led program has the greatest potential to be academically integrated given that campus faculty often teach their own courses abroad with many of the students coming from their own college or university. Taken as a whole, the field of study abroad

has specialized itself into a number of variants, which vary in their relative integration into the undergraduate curriculum. In response to this expansion, scholars and professionals have begun to stress the evaluation and assessment of both learning goals and the programs themselves. This work is discussed below.

Review of Study Abroad Literature

The literature on study abroad is ill proportioned. On the one hand, large-scale survey and demographic research is long-standing and fairly extensive. Pioneered by IIE, which has continuously gathered data for over 60 years, these statistics provide considerable insights into both study abroad and international student mobility. For instance, IIE data show that more women study abroad than men; students in these programs are slowly becoming more diverse; students are overwhelmingly choosing short-term programs over long-term ones; and a historically small, but growing, percentage of math and engineering students participate in education abroad (Farrugia & Bhandari, 2013). Beyond such descriptive statistics, there is considerable depth in the research on the traditional learning outcomes most often associated with education abroad (e.g., foreign language acquisition, intercultural competency). On the other hand, proper assessment of the actual programs has lagged behind the research on learning outcomes. While there is some emerging work in this area, there continues to be a dearth of literature on program assessment, especially on the efficacy of short-term programming. However, the least explored area of research is the role that faculty members play in both education abroad and internationalization of the curriculum.³ With these limitations in mind, the following section will explore the literature on learning outcomes, program assessment, and the role of faculty.

Learning Outcomes

The literature on learning outcomes attributable to study abroad is expanding. There is general agreement that regular assessment of learning goals is a necessary best practice. Common learning goals include foreign language acquisition, intellectual growth, personal growth, intercultural skills and self-awareness, and professional development (Ingraham & Peterson, 2004; Sutton & Rubin, 2004). Many in the field are now calling for rigorous controlled quantitative research studies to truly measure such outcomes (McLeod & Wainwright, 2009). The two most commonly measured outcomes are foreign language acquisition and intercultural learning. With respect to the former, there is considerable depth, as initial studies confirmed long-held assumptions and found that time spent abroad was positively correlated with foreign language proficiency (Carrol, 1967). Since that time, researchers have examined this phenomenon more closely, looking at specific program characteristics that optimize foreign language acquisition (Davidson, 2010). Intercultural learning, or global competency, is another key area of investigation, and is often pointed to as a principal goal of *all* study abroad programs, no matter how short or long. Global competency simply means the ability to understand the cultural norms and expectations of others while using this knowledge to successfully interact with people outside one's own environment (Hunter, et al., 2006). In general, the literature shows that students who study abroad are more likely than those who did not will have higher levels of intercultural proficiency, knowledge of global interdependence, and knowledge of cultural relativism (Braskamp, et al., 2009; Clarke, et al., 2009; Rexeisen, 2012-2013; and Sutton & Rubin, 2004). That said, there is a dearth of research on whether students make adequate progress on their major

³ Study abroad is considered on part of any effort to internationalize the curriculum on college and university campuses.

or disciplinary goals while abroad in the same way that students studying on their home campuses do.

Program Assessment

A natural outgrowth of research on learning outcomes is program assessment. However, for a long time study abroad professionals operated on the principle that most or all programs produced positive outcomes, and did not focus much attention on assessment. When assessment did occur, programs were often evaluated with relatively simplistic research methods without the use of control groups or studies that are grounded in theory. For instance, many programs ask their students to fill out simple surveys that relate to their experiences abroad; if student comments were positive, then the program was often deemed successful (McLeod & Wainwright, 2009). Indeed, a recent survey showed that only 39% of study abroad offices assessed their programs to determine if they attained their stated learning outcomes (Forum on Education Abroad, 2014). However, the accountability movement in higher education, which calls for institutions to justify public spending through the regular reporting of key metrics, has begun to impact study abroad as well (Gillespie, et al., 1999; Vande Berg, 2007). As a starting point, this research has tried to justify education abroad on whether such experiences present students with emotional and intellectual challenges of direct, authentic, and cultural encounters that cannot be found on the home campuses (Engle & Engle, 2003). Other justifications are based on the benefits on the student level (personal growth, global competency, professional development), the societal level (development of a global citizenry, preparation for the global economy), and the institutional level (internationalization, branding) (Wells, 2006). In general, the literature shows that students participating in longer-term programs accrue more benefits than those participating in short-term programs (Dwyer, 2004; Kehl & Morris, 2007-2008).⁴ Given the predominance of long-term programming for most of its history, there is a bias in favor of these programs over shorter ones, with some scholars making the point that short-term programs blur the distinction between education abroad and “educational tourism” (Woolf, 2007).

However, some research has begun to focus on the value of short-term programming. One study looked at a carefully designed three-stage short-term research program in a Costa Rican rain forest, and showed that students made strong gains in specific disciplinary learning areas, such as the application of field research practices. However, students perceived other skills related to intercultural learning as lifelong and applicable to multiple areas of their lives beyond environmental science. This study also showed that one key to the optimization of short-term programs is the integration of inquiry-based active learning into the curricular design and assessment of short-term study abroad programs (McLaughlin & Johnson, 2006). While some scholars have critiqued short-term programs for not achieving the more substantial learning outcomes found in longer term programs, other researchers have concluded that students do make gains in self-confidence, some functional knowledge, linguistic awareness and an increased likelihood to communicate in a foreign language, cross-cultural perspectives, attitudinal reflection and appreciation for out-of-classroom learning, and some academic skills development (Chiefo & Griffiths, 2004; McLaughlin & Johnson, 2006, Zamastil-Vondrova, 2005). Some researchers have also concluded that critical self-reflection is especially important in achieving the learning goals of short-term programs (Riggan, et al., 2011). Regardless of

⁴ Such benefits include direct enrollment in foreign university courses, increased confidence in linguistic abilities, increased interest in academic study, and higher likelihood to pursue graduate study, and increased levels of global mindedness

the length of the program being assessed, all successful program types emphasize the proactive role in faculty.

Role of Faculty

Active participation of faculty has long been seen as a necessary component for successful study abroad programs. Indeed, it has been shown to be a key factor in increasing participation rates (Doyle, et al., 2010; Paus & Robinson, 2008). There is also considerable advocacy to systematically include faculty members in the study abroad enterprise on college campuses (Stohl, 2007; Vande Berg, 2007). The *Forum on Education Abroad's Survey of Curriculum Integration* in 2004 showed a positive relationship between faculty involvement in academic integration of study abroad programs and major credit transfer (Woodruff, et al., 2005). While causality is difficult to determine, analysis of the UMN curricular integration initiative found a positive correlation between faculty involvement in this initiative and their attitudes, beliefs, and knowledge about education abroad (Woodruff, 2009). Another case study found that internationalization was slow when there was irregular faculty participation, particularly in the face of a clear lack of faculty ownership in the process (Coryell, et al., 2010). Although early research on faculty engagement approached faculty as a monolith, recent literature has concluded that successful internationalization is actually dependent on distinct disciplinary contexts and/or disciplinary communities of inquiry (Breit, et al., 2013; Fitch, 2013; Green & Whitsed, 2013; Leask, 2012). Study abroad can be considered one component of the internationalization of the curriculum, and therefore serves as a good proxy for understanding faculty engagement in the former. With respect to internationalization of the curriculum, one researcher has observed that those in the STEM fields value disciplinary skills above global competencies. While many faculty in these fields recognize the importance of the latter given that their graduates will need to compete in a global marketplace, they place an emphasis on research and other technical skills. They also characterized their field as homogeneous across borders, especially when it comes to the collection and measurement of data. On the other hand, faculty in the social sciences often place high value on global citizenry, experiential learning, and critical self-reflection, especially in contexts and environments that challenge students' beliefs and perspectives. Likewise, faculty in the humanities also value experiential learning, especially in the application of interdisciplinary and/or multi-disciplinary knowledge to real-world problems. Above all, the disciplines in the humanities are highly interpretive and dependent on the local context for the generation of new knowledge (Agnew, 2013).

The specific learning outcomes afforded to study abroad, especially long-term programs, are well documented. Despite this, program assessment by type and duration is less than comprehensive. Although some studies do exist, the literature on short-term programs is lacking, with most scholars taking the view that longer is better. Regardless of program type and duration, there is general agreement that faculty participation increases the academic integration of education abroad into the curriculum, but there really is little dedicated research in this area. Instead, the literature is expanding on faculty engagement within the context of internationalization of the curriculum, within which study abroad plays a role. Yet this literature has begun to investigate the disciplines as the drivers of internationalization. This is a promising area of research, as it begins to explain motivations of faculty involvement in both study abroad and internationalization in general. It also serves as a jumping off point for this paper. The argument furthered here is for a reimagining of education abroad that fuses short-term programming with some kind of experiential research component led by home campus *disciplinary* faculty, especially those in the STEM fields, in order to better integrate the study abroad

program into the core undergraduate curriculum.

The State of Academic Integration within Study Abroad

Historically speaking, many study abroad offices have been somewhat removed from the institution's faculty or its academic core, and thereby not truly integrated into academic departments. The fact that many institutions, especially smaller ones, utilize third-party providers has in part facilitated this. This inevitably results in programs that have little contact with either departmental faculty or even academic advisors. As a case in point, the Forum on Education Abroad found that in 2013 only 57% of U.S. institutions utilized an academic oversight committee to identify and approve all for-credit study abroad programs (Forum on Education Abroad, 2014). Indeed, studies are showing that students are becoming increasingly more sensitive to time-to-degree, indicating that the lack of academic integration continues to be an impediment to participation (Doyle, et al., 2010; Otero & McCoshan, 2006; Stroud, 2010). In the face of such findings, 'curricular integration' and 'academic integration' are certainly buzzwords within the field. That said, most academic integration efforts are still based on the UMN model, which tries to fit majors to existing study abroad programs.⁵ In other cases, new 'global studies' or 'international studies' majors are created in the hope that these students will flock to study abroad programs. The goal of these approaches is to facilitate the transfer of some academic course credits for general education, major, and/or minor requirements. However, only a minority of students transfers *all* courses taken abroad. While these approaches work fairly well for students in the humanities, social sciences, and even business majors, which all have somewhat flexible curricula, it does not work so well for students in the STEM majors. These students have difficulty getting away for a full term study abroad program, and their strict curricula limits the transferability of many courses taken abroad.

While some institutions try to encourage STEM participants by partnering with technical or engineering international institutions, these partnerships are relatively few in number when compared to the total number of programs in the market. Within UCEAP for example, there exist special relationships with the Technical University in Berlin, Imperial College in London, and the Hong Kong University of Science and Technology to name just a few.⁶ In recent years, some campuses have moved beyond both immersion and island programs in order to attract STEM students, developing short-term faculty-led programs with the help of the local study abroad office on such issues as logistics and program planning. These programs are naturally better integrated into the curriculum than other program types simply because students receive direct major academic credit for these courses, as opposed to petitioning departments for academic equivalences upon their return. For instance, UC Davis has partnered with STEM faculty members in engineering to create faculty-led engineering programs in Ireland, Italy, and South Korea. In these programs, students receive eight units of

⁵ Directly articulating major courses to study abroad program courses is difficult. Given that academic departments have a strong interest in maintaining academic control over their courses, they are reluctant to guarantee automatic major credit pre-departure. In most cases, students are responsible for retroactively petitioning their departments for academic credit after they return from their sojourns. To facilitate student course selection while abroad, many study abroad offices publish lists of courses that have been approved in the past by certain departments; however, this is not a guarantee of future approvals.

⁶ See <http://eap.ucop.edu/OurPrograms/Pages/engineering.aspx>.

academic credit for a program that takes place entirely in the summer, thereby alleviating the curricular pressure on STEM students.⁷ Likewise, UC Berkeley (UCB) and UC San Diego (UCSD) offer programs for its STEM students (and other majors) in the form of Global Seminars and other summer programs, which are usually led by UCB or UCSD professors.⁸

As shown by the previous examples, faculty are essential to true academic integration not only for the design of new programs, but also providing oversight, assessment, and accountability over existing ones (Vande Berg, 2007). Given the predominance of humanities and social sciences students in education abroad, it is not surprising that a good portion of the faculty members involved come from these disciplines as well. More often than not, faculty relationships with the study abroad office are uneven, and vary by department, often following the ‘faculty champion’ model.⁹ In part, this mode of participation can be explained by recent research on disciplinary approaches to internationalization. Although there are usually significant numbers of faculty members in the hard applied sciences (e.g., engineering) who have international backgrounds, they do not seem to be involved in study abroad in the same proportions as those in the humanities and the social sciences. This may be due to the way(s) in which faculty from these disciplines approach undergraduate education within their respective majors. For instance, as noted above, faculty in the humanities and the social sciences will place weight not only on intercultural learning, but also on presenting their students with challenges in novel environments that test their beliefs and perspectives. Given this emphasis, it is therefore not surprising that faculty in these disciplines would not only encourage their students to study abroad, but become involved in the enterprise themselves.

On the other hand, STEM faculty might look askance at education abroad opportunities, seeing them more as distractions from gaining valuable disciplinary competencies such as research and technical skills. Foreign language also plays a role. Whereas a faculty member in the humanities or social sciences might view foreign language acquisition as a valuable skill to access source material or conduct surveys in the local language, English is the language of research in the STEM fields given the predominance of research universities in the United Kingdom and the United States. This is analogous to the status that German enjoyed as the language of learning in the nineteenth century.¹⁰

⁷ See https://studyabroad.ucdavis.edu/students/academics_gis.html. Other similar programs include a pharmaceutical chemistry program in Taiwan for students in the Physical Sciences; three environmental policy and sustainability programs for Environmental Science and Biology majors; food programs in China and France (wine making) for students in the Agricultural Sciences, Biotechnology, Food Sciences, and Viticulture and Enology; a multi-site program in genetics, health internship programs in Mexico and the United Kingdom, and a microbiology laboratory program in Thailand for Health Science majors

⁸ For UCB’s summer programs, see <http://studyabroad.berkeley.edu/summerabroad>; for UCSD’s summer programs, see <http://icenter.ucsd.edu/pao/start-your-journey/program-options/global-seminars/index.html>.

⁹ The faculty ‘champion’ is one in which certain faculty members are ardent supporters of study abroad, and often serve multiple roles within study abroad locally, e.g. advising students on study abroad options, leading programs abroad, serving as the faculty director on campus, providing advice on new programs, etc.

¹⁰ During this time, the German University system was seen as the model for the world, much like the US university system is seen today. See Lenore O’Boyle, “Learning for Its Own Sake: The

Thus, STEM faculty may engage in international collaboration as a means to solve disciplinary problems and challenges that may be international in nature. Indeed, this might be the preferred mode of internationalization over study abroad in these disciplines. However, unequal distribution across disciplines remains a real problem, and may have depressed STEM participation in education abroad. What is needed therefore is an alternative mode of study abroad programming that will create disciplinary buy-in from STEM faculty who can encourage and facilitate better STEM student participation. One such vehicle for better engagement is undergraduate research.

Growth in Undergraduate Research at Home and Abroad

At the same time that students began to clamor for short-term study abroad programming in the late 1990s, there was a parallel increase in undergraduate research at U.S. colleges and universities. The Boyer Report (1998) served as an impetus for inserting undergraduate research and the ‘student-scholar’ model into the American higher education system. That report advocated the facilitation of undergraduate research as early as the freshman year, as well as the creation of carefully constructed research opportunities and internships that can turn inquiry-based learning into practical experiences (Boyer Commission, 1998).¹¹ Today there is little doubt that this area of undergraduate learning has experienced significant growth, not only at research universities, but at all types of institutions (Hu, et al., 2007).¹² Other surveys show that a substantial percentage of seniors work directly with faculty on their research. Approximately 25% of seniors at doctoral institutions participate in such activities, 23% of seniors at Master’s institutions do, and 44% of seniors at baccalaureate colleges do. And many of the most active undergraduates come from the STEM fields, which is illustrated graphically below. For instance, 45% of seniors majoring in the biological sciences, agriculture, and natural resources conduct research, 39% of seniors in the physical sciences, math, and computer sciences do, and 30% of seniors in engineering are engaged in undergraduate research (NSSE, 2013). The fact that some majors and minors even require undergraduate research as a capstone can be seen as evidence of its value. For example, UCB’s minor in *Global Poverty and Practice Minor* requires a ‘Practical Experience,’ which requires students to work with non-governmental organizations, government agencies, social movements, and/or community projects on various issues related to poverty.¹³

Given the popularity of undergraduate research at home, it is not surprising that more students are undertaking similar endeavors abroad, either within the context of an established program or on their own. The IIE reports that experiential learning (which includes undergraduate research) is one of fastest growing segments in study abroad, registering a 47% increase from 2010-11 to 2011-12

German University as Nineteenth Century Model.” *Comparative Studies in Society and History*, 25 (1), (January 1983), 3-25.

¹¹ This concept is based on John Dewey’s ideas on learning, that real learning takes place when discovery is guided by mentoring rather than on the simple transmission of information. Embedded in this concept is the notion that faculty are learning from the students at the same time that students are learning from the faculty.

¹² In the 2000s, a number of undergraduate research organizations grew significantly, including the Council on Undergraduate Research, Project Kaleidoscope, the National Conference on Undergraduate Research, and the Reinvention Center, and even some undergraduate research journals (e.g., ‘Pursuit’ from the University of Tennessee).

¹³ See <http://blumcenter.berkeley.edu/education/gpp/>.

(Farrugia & Bhandari, 2013). In-program examples include UCEAP's field and laboratory research programs in Costa Rica, Japan, Mexico, Singapore, and Taiwan.¹⁴ Some individual UC campuses, such as UC Irvine (UCI) offer research opportunities abroad via associations with external organizations, as well as campus-specific programs.¹⁵ While the number of for-credit formal study abroad research programs has increased, there is also considerable growth in the numbers of students pursuing independent research projects abroad. Indeed, international funding opportunities do exist through the National Science Foundation (e.g., the Research Experiences for Undergraduates program) and other international funding organizations for undergraduate students pursuing international research.¹⁶ The value of these experiences is being confirmed by current research as well. The National Survey of Student Engagement (NSSE) identified not only study abroad, but also service learning, internships, research with faculty members as "high impact" experiences (NSSE, 2013). Researchers have found that students who participated in such activities grew both personally and professionally, developed valuable skills, and improved their career preparation (Seymour, et al., 2004). With respect to STEM students, another study showed that there is a positive correlation between freshmen working directly with faculty and not only staying within the particular STEM major, but also graduating (Graham, et al., 2013). While conducting undergraduate research abroad imbues students with the learning outcomes noted above, there are the additional benefits of greater linguistic competence, cross-cultural skills, and cultural competence (Bolen & Martin, 2005). It is therefore clear that institutions are beginning to embrace the value of undergraduate research; expanding these opportunities farther afield may depend on how extant research relationships among faculty at home and abroad can be leveraged.

International Research Collaborations & Implications for Study Abroad

As suggested above, STEM faculty primarily engage in international collaboration to solve global scientific challenges. The reasons for collaboration are apparent, as many of today's scientific challenges are global in nature (e.g., climate change) or are so large that they require multiple researchers working on the same problem. In addition, through international collaboration, scientists seek out the best and brightest in their fields, and are able to access facilities that may not be available at home (e.g. scientific facilities at the European Organization for Nuclear Research, or CERN). Advances in communications technology and the Internet have played a major role, contributing to the frequent and multiple collaborations that were simply not possible in the past. It is therefore not surprising that the number of international co-authorships have risen significantly. What is more, international research collaborations are primarily clustered within the STEM fields.¹⁷ From 1997 to 2012, the number of science and engineering (S&E) articles in peer-reviewed journals by co-authors

¹⁴ See <http://eap.ucop.edu/OurPrograms/Pages/Research.aspx>.

¹⁵ See <http://www.studyabroad.uci.edu/prospective/iopother/research.shtml#w>.

¹⁶ Such organizations and scholarships as the Paul W. Zuccaire Internship Program Pasteur Foundation (France), Perimeter Institute for Theoretical Physics (Canada), SIT Study Abroad, Germany research opportunities, École Polytechnique Fédérale de Lausanne (Switzerland), University of Tokyo Research Internship Program (Japan), and Village Reach (Mozambique).

¹⁷ By disciplinary area, astronomy leads with 56% international co-authored papers in journals; this is followed by the geosciences, computer sciences, mathematics, physics, and biological sciences, which have rates of international co-authorship between 27% and 34%. The social sciences and psychology have somewhat of the lower rates of collaboration, only between 17% and 24%.

from different countries increased from 14% to 25%. The National Science Foundation now reports that 35% of U.S. S&E co-authored articles are international in scope. Figure 3 shows the clustering of international collaborations resulting in journal articles by discipline, as well as their growth since 1997. With the increase in this kind of collaboration, there may be unique opportunities for study abroad to tap into burgeoning networks of international faculty collaboration to better institutionalize undergraduate research that is completely integrated into the curriculum.

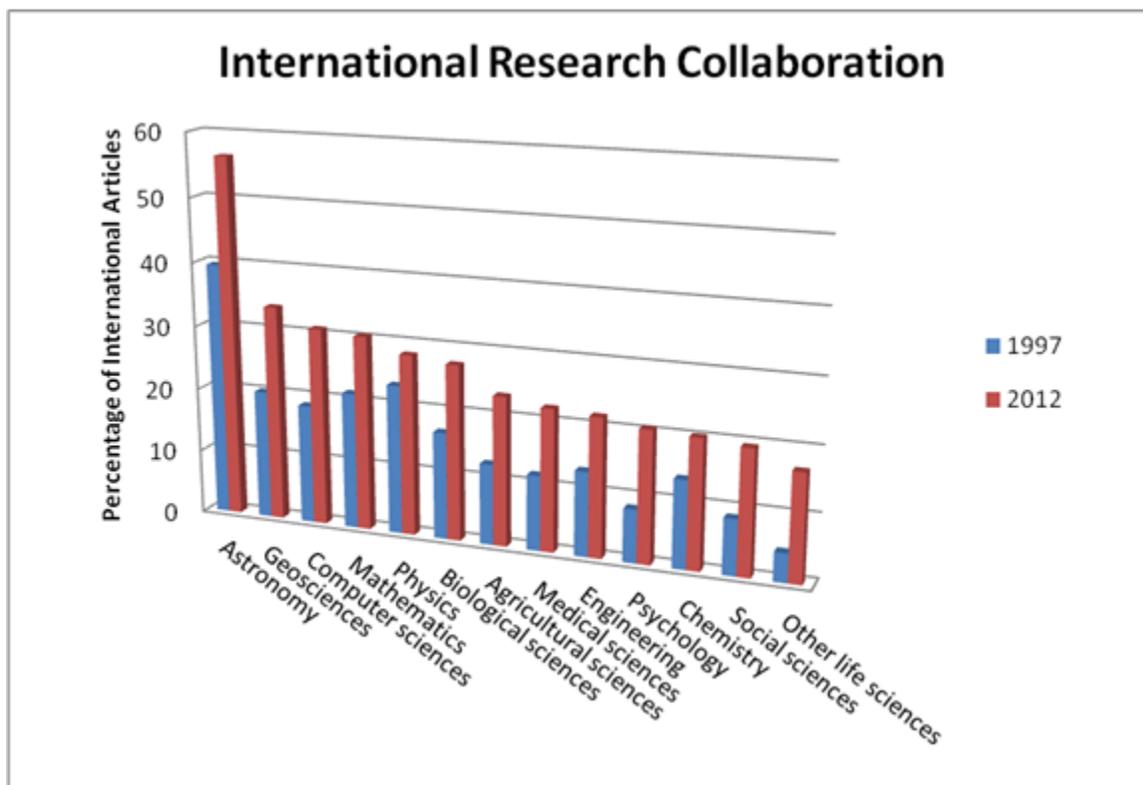


Figure 3: Share of world's S&E articles with international collaboration; Source: National Science Foundation (2014).

Given today's interconnected global world, it is not surprising that international research collaborations have increased. What makes it interesting is how well the patterns of these emerging networks correspond to existing study abroad program locations. New scientific hubs are being established in Sao Paulo, Beijing, Nanjing, Shanghai, Hong Kong, Seoul, and Taipei. Outside these major centers, India is also not far behind in developing its research expertise and capacity (The Royal Society, 2011). Many of these cities also house study centers of large education abroad third-party providers and consortia, as the numbers of students studying at these non-traditional locations have significantly increased over the last ten years or so.¹⁸ In addition, U.S. scholars have preferred partners for research collaborations: with China at 16%, followed by the United Kingdom (14%), Germany (13%), Canada (11%), France (9%), Italy (7%), and Japan (7%). Outside of U.S.-initiated papers, more than 50% of the international S&E articles from Israel, South Korea, and Taiwan have participation from U.S. researchers (National Science Board, 2014). The table below shows how well the biggest

¹⁸ Between 2010-11 and 2011-12, students studying abroad in Singapore increasing by 58%, Hong Kong by 42.7%, and Japan by 27.8% (Farrugia & Bhandari, 2013).

partners in U.S. international co-authored journal articles align with study abroad destinations.

Table 1: Share of world's S&E articles with international collaboration and selected study abroad destinations; Sources: National Science Foundation (2014) and the Institute of International Education, Open Doors (2013)

Comparison between Top Country Shares of U.S. Internationally Coauthored Articles and Study Abroad Destinations, 2012		
Country	% U.S. International Coauthored Articles	% Study Abroad Participation
China	16.2	5.3
United Kingdom	14.3	12.2
Germany	13.3	3.3
Canada	11.4	
France	8.8	6.1
Italy	7.4	10.5
Japan	6.8	1.9

In particular, the table above illustrates a couple of different trends. Although individual study abroad programs have increased their research offerings at many of these locations, most are doing so along the lines of established institutional partners, not campus faculty who may have research connections overseas. For example, UCEAP has established its research programs with such long-standing partners as the National Autonomous University of Mexico (UNAM) in Mexico, University of Queensland in Australia, University of Tokyo in Japan, National Taiwan University, and the National University of Singapore. In other cases, new research programs are established with new external partners, including some third-party providers. Expanding research in this way makes sense from a resource perspective, but may not optimize the academic integration of research programs with campus faculty. Indeed, the potential for the optimal integration of customized programs with campus faculty is the principal advantage that such programs hold over external undergraduate research programs. Another issue is the significant number of students taking part in independent research activities abroad, which have increased by almost 47% between 2010-11 and 2011-12 (Farrugia & Bhandari, 2013). Without anchoring undergraduate overseas research to a study abroad program, students are at a greater risk of not receiving academic credit for their work if pursued independently.

The significant numbers of faculty engaging in international research collaborations shows that there is significant potential to further expand study abroad programs that focus on undergraduate research, especially for STEM majors. The development of such programs would solve a number of chronic problems that has plagued the field for a long time: attracting STEM students, incorporating STEM faculty into the core programs, and developing programs that are truly integrated into the campus's undergraduate curriculum. Given that STEM students have a difficult time getting away for study abroad during the regular academic year, aligning a special program connected to a campus faculty member's summer research agenda is a logical way to broaden study abroad appeal to a traditionally underserved segment of the undergraduate population. What is new is the possibility of directly tapping into faculty research networks to build carefully constructed short-term summer

programs that concentrate on active faculty research. Graduate students, working as research assistants on faculty grants (or even pursuing their own independent research), already do this. The key difference is the need for more directed research for undergraduate students.

How would homegrown study abroad research programs be designed and implemented? One way would be for study abroad offices to develop short programs based upon local faculty research interests. Campus faculty members conducting international research would participate in such customized undergraduate research programs as mentors. They could also teach related courses abroad for academic credit (as well as instructing students on field research), thereby ensuring direct integration into students' majors. One example is UCB's *Dhiban Archaeological Field School in Jordan*.¹⁹ The Dhiban School is part of the Dhiban Excavation and Development Project, which is an ongoing research project on the archaeology, environment, and history of Dhiban in Jordan. Students in this summer program receive instruction in archaeological and environmental field research through field and laboratory research, classroom seminars, lectures, and field trips. This program is unique from some other external research programs in that a UCB faculty member is the co-director of the project, and provides instruction on-site. Boston University (BU) offers another example in its *Ecuador Tropical Ecology Program*, which is a semester long field-based ecology program taught by both BU and Universidad San Francisco de Quito faculty members. Once again, a BU faculty member serves as co-director of the program. Upon conclusion of the program, students earn 18 BU academic credits.²⁰

Service learning provides similar opportunities for undergraduate students to work with local faculty abroad. For instance, UC Irvine's (UCI) *Costa Rica Program* provides a cultural immersion experiential experience for a small number of UCI students. It also includes a pre-departure quarter-long course, along with post-return leadership activities that highlight the program to local stakeholders. The program itself offers six to eight units of academic credit through UCI's Civic Engagement minor. Although this is an example of a service-learning type program that emphasizes sustainability, and not research per se, the format allows students to develop their own research projects, which are presented to the UCI community after their return. It also demonstrates the potential of using campus resources to develop programs that are highly integrated into the campus's undergraduate curriculum.²¹ It should be noted that smaller universities in some ways do a better job in putting on research and experiential programs. For example, in 2007 the Dominican University of California School of Education and Counseling Psychology (SECP) initiated a project in which teacher candidates were sent to a private school in Cape Town, South Africa to work in math and science classrooms with 9th-12th grade black students who were living in poverty and were being educated in a post-apartheid education system. In the initial phase the focus was to engage students from the field of Education, and was subsequently expanded in 2012 to include students from Business, Science, and Occupational Therapy to build a cross-disciplinary team. The objectives included providing quality teacher training, developing mathematics, science and health curricula, training school personnel in budget planning and implementation, and implementing a research

¹⁹ See http://nes.berkeley.edu/Web_Porter/Dhiban/Welcome.html.

²⁰ See <http://www.bu.edu/abroad/programs/ecuador-tropical-ecology-program/>. This program even allows for graduate credit if additional independent research is undertaken after the conclusion of the program.

²¹ See <http://sites.uci.edu/costaricaprogram/>.

agenda in black public township high schools in Port Elizabeth, South Africa. Both undergraduate and graduate students were involved in the project, which offered intense and engaging international experiences for faculty and students. The students were enrolled in courses in their respective disciplines and met and discussed assigned readings from both a cross-disciplinary and international perspectives. In addition, participants worked with students, faculty and administrators in South African schools for five weeks during the summer.

As attractive as this model is, there are a number of challenges that could limit its realization by study abroad offices. The most significant of these is simple access to STEM faculty, which could be facilitated through the use of a local database of undergraduate research opportunities. There are a couple of successful examples of such electronic portals (for students) or programs that bridge the gap between undergraduate research opportunities at home and students. These include the *Undergraduate Research Program* at the University of Washington (UW)²², UCSD's *Undergraduate Research*²³, and UCI's *Undergraduate Research Opportunities Program*²⁴. All of these programs either allow individual faculty members to post undergraduate research opportunities or facilitate such research. In addition, there are sponsorship opportunities and support from local academic affairs offices and/or research units to ensure that students receive the necessary training in research (e.g., safety, ethics, human subjects, etc.) and mentoring. For the students, there are usually options to publish student work in undergraduate research journals and present the research to the local college community in some kind of symposium. Encouraging faculty engaged in international research to post their own opportunities would be a logical next step. Indeed, UW has taken some steps to broaden its reach, and has posted links to a number of organizations and scholarships that facilitate international undergraduate research.²⁵ Expanding these portals would demand partnerships with local study abroad offices, which would not only be responsible for vetting the opportunities but also designing and integrating appropriate programs to accommodate such research. Appropriate vetting of all international undergraduate research opportunities by various faculty committees to ensure academic quality would also need to be done. Ideally, this could be accomplished through the mechanism of the faculty shared governance structure, with the local study abroad office as the key-coordinating agency. At a minimum, a special faculty advisory committee or international education committee, composed of representative disciplinary faculty members, as well as the institutional review board, would need to be consulted.

Logistics and program design are two critical elements in any education abroad program, but even more important in undergraduate research-based programs. Study abroad offices have gained considerable expertise in putting on programs over the years, which would enable them to assist faculty in hosting and mentoring undergraduate students abroad. For instance, successful programs emphasize pre-departure seminars/webinars to impart basic essential background knowledge, well-designed on-site program elements that emphasize field-based experiences, peer discussions, research presentations, and data recording activities. Finally, post-trip assessment, symposiums, and post-trip

²² See <http://www.washington.edu/research/urp/>.

²³ See <http://urp.ucsd.edu>.

²⁴ See <http://www.urop.uci.edu/about.html>.

²⁵ See Summer Research Beyond UW at <http://www.washington.edu/research/urp/students/find/summerbeyondUW.html>.

academic requirements (e.g., a paper, presentation at a conference, etc.) are integral parts of successful programs (McLaughlin & Johnson, 2006). By partnering with local research units to provide the research-related training (e.g., research ethics, human subjects, etc.) before departure, study abroad offices could develop program models for these opportunities, even flexible ones that vary their geographical locations from year-to-year. Even more importantly, there now exists an extensive network of third-party study abroad providers and institutional partners that could facilitate the logistics of these arrangements worldwide at many research locations. Many of these study centers include local staff, as well as liaison faculty members at nearby universities. Indeed, UCEAP's established research programs already utilize their study centers to coordinate placement and other activities through institutional partners, so this model is not entirely foreign to what is done now. For smaller colleges, which may not have sufficient resources to mount such programs, utilizing third-party providers may be one option. As only one example, CIEE, a well-established third-party provider, has a special *Faculty and Custom Programs* unit, which is designed to provide both logistics and academic programming through any one of its 50 study centers around the world.²⁶

Conclusion

The literature shows that study abroad imbues undergraduate students with such valuable learning outcomes of intercultural learning and global awareness, foreign language acquisition, some disciplinary learning goals, and other positive long-term impacts. While study abroad has been growing at substantial rates over the last twenty years, students in the STEM majors remain a largely underserved segment of the undergraduate population. One reason for this is the less than optimal curricular integration of study abroad programming and the lack of participation from faculty members, especially in the STEM fields. At the same time, undergraduate research has flourished at many U.S. colleges and universities, with some faculty developing extensive international research networks. However, study abroad for the most part has failed to leverage these burgeoning international networks to develop undergraduate research with campus faculty members. The lack of development in this area misses an opportunity to incorporate STEM faculty into education abroad, who generally value disciplinary skills, and see internationalization as a means to apply them to solve challenges in global contexts.

By utilizing campus faculty members to lead summer research, study abroad would be able to create flexible short-term programs that are totally integrated into the curriculum, with an emphasis on viable options for STEM students. One can find parallels to this approach in the development of current short-term faculty-led programs. If designed well, these programs are well integrated into the curriculum, as the examples from UCB, UCI, BU, and Dominican University demonstrate. Despite the potential for these kinds of programs, there remain a number of challenges that study abroad offices will need to overcome to make them more widespread. However, the foundations for meeting these challenges have been laid down in the form of established on-campus undergraduate research programs. With appropriate partnerships between study abroad and research/academic affairs offices, these programs could be expanded to include more international research opportunities. If successful on a large scale, these programs would facilitate the significant growth of STEM student participation in education abroad. More importantly however, they could develop a new generation of scientists and engineers who not only have the disciplinary and research skills to tackle the world's scientific

²⁶ See <http://www.ciee.org/study-abroad/advisors/custom/>.

grand challenges, but also have the intercultural capabilities to work with best and brightest around the world to create, innovate, and implement new technologies.

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