ABSTRACT OF CAPSTONE

Michael S. Keibler

The Graduate School

Morehead State University

March 25, 2020

INTERNATIONALIZATION OF CURRICULUM IN HIGHER EDUCATION: AN ACTION RESEARCH STUDY ON A GLOBAL ENGINEERING TRACK

Abstract of Capstone

A capstone submitted in partial fulfillment of the
Requirements for the degree of Doctor of Education in the
College of Education
At Morehead State University

By

Michael S. Keibler

Crandall, Indiana

Committee Chair: Daryl R. Privott, Associate Professor

Morehead, Kentucky

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Employers in the U.S. are recruiting engineering students who have intercultural competencies and can solve complex global engineering problems. However, a stringent engineering curriculum leaves little room for students to gain intercultural competencies, particularly for those enrolled in programs with mandatory cooperative education. An extensive literature review on the internationalization of curriculum in higher education documents program approaches, benefits, and learning outcomes. While there is broad agreement participation in global experiences fosters strands of intercultural competencies, there is less agreement as to which singular program approaches promote specific cultural learning outcomes. This action research study illuminates the concept of a Global Engineering Track and how its curriculum, co-curriculum, experiential education, and critical reflection stages can act as combined contributors towards developing intercultural authenticity. A conceptual theoretical framework defines how engineering programs can combine singular transformative engineering activities to reconceptualize an engineering curriculum.

KEYWORDS: internationalization, higher education, study abroad, global engineering, and transformative learning.

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Candidate Signature

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DEDICATION

This capstone is dedicated to the students who travel abroad. Their fearless approach to learning leans on the discipline of academics and rests in their lived experiences. It is dedicated to those who love the pursuit of knowledge, at any point in life, and their desire to understand not only themselves but others whose culture may be different from their own.

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Finally, I am thankful for the favor and persistence God granted me so that I could complete this capstone project and degree. He instilled in me the desire, dream, and dedication to pursue a doctoral program. I will be a good steward of both His investment and this degree.

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Internationalization of Curriculum in Higher Education:
An Action Research Study on a Global Engineering Track

Executive Summary

Employers in the U.S. are focused on recruiting globally minded engineering students who hold intercultural competence and are able to solve complex global engineering problems (Downey et al., 2006; Mihelcic et al., 2008). They are recruiting engineering students who possess high cultural intelligence and understand the value of global diversity. Commander, Zhao, Gallagher, and You (2015) argue that the internationalization of curriculum is crucial due to the increasing employer demand for recruiting students who can work with others from different cultures. Another reason supporting this demand is that working on multi-national teams where there are no lines between designing products made in one part of the world and sold in another is not uncommon (Kerzmann, 2016; Parkinson, 2007). Kerzmann (2016) further contends that soft skills such as communication and collaboration are listed as priorities on an employer's list, and engineering students must have exposure to a broad understanding of different cultures and countries.

In response to this demand, institutions are beginning to investigate new ways to develop intercultural competencies in engineering students (Mazzurco, A., Jesiek, B., 2012; Mills, Deviney, & Ball, 2010). The internationalization of curriculum as an option is not a new concept in higher education. It has been a strategy dating back as far as the 16th century as a way to preserve cultural and natural dignity while preparing students for a global world and a society of multiculturalism under the

mantra of internationalization (Clifford & Montgomery, 2015; Grainger, Carey, Christie, & Robertson, 2015; Leask, 2013).

Today, accreditation commissions like the Accreditation Board for Engineering and Technology (ABET) are holding institutions accountable for the self-assessment and continuous improvement of curriculum towards student readiness for 21st-century competencies. ABET accreditation is one way to ensure institutions are held to strict curriculum and learning outcome standards. According to ABET.com, 812 colleges and universities in 32 countries have received ABET accreditation. Of those colleges and universities, only eight have mandatory cooperative education – the University of Louisville, University of Cincinnati, Toledo University, Grand Valley Station University, Rochester Institute of Technology, University of Akron, Drexel University, and Kettering University.

Many accrediting agencies in higher education have expanded their assessment criterion to include aspects of cultural or global competence as an outcome of learning. As an example, ABET added global and communication soft skills as required skills in engineering graduates (Blumenthal & Grothus, 2008). The ABET accreditation processes assure that the internationalization of curriculum in higher education is finding ways to embed culturally centered activities and experiences in the curriculum to develop global engineering students. Huang (2017b) proposes that the internationalization of curriculum should be accepted as a strategy for the cultivation of students and institutional development.

However, developing a global engineering student remains complex and challenging as a typical engineering curriculum has little to no room to academically foster or develop global citizenship (Grudzinski-Hall, Jellison, Stewart-Gambino, & Weisman, 2007), particularly in mandatory cooperative education programs. Mandatory cooperative education programs require engineering schools to take a more pragmatic and applicable approach towards providing an internationalized curriculum. An approach extending beyond the boundaries of the classroom and lectures and towards an engaging cultural understanding is vital and lacking (Huang, 2017; Svensson & Wihlborg, 2010). International affordances, such as short-term study abroad, have the highest potential to shape the next generation of global engineering students' cultural collaborative and communication skills to reach across those global differences and boundaries (Ramírez, 2013).

One approach to the internationalization of curriculum in engineering is to embed forms of intercultural development directly into the curriculum, offering a program in which learning outcomes live across stages of immersive global learning experiences and intentional cultural intersections (AACU, 2017). Internationalization through these types of affordances can produce desired employer outcomes as well as open-mindedness, adaptability, and the promotion of diverse cultures towards forms of ethno-relativism (Bennett, 1986, 2017). Deardorff (2006) believes that the intercultural competence of students lies in the internationalization efforts of higher education institutions. Similarly, Lilley, Barker, and Harris (2017) consider these institutional efforts as a way to address how structured global programs, affordances,

and activities function as a transformational approach to shape intercultural authenticity in engineering students and produce an ideal global graduate.

At the University of Louisville, there was a charge to increase the number of students participating in education abroad to 1500 by the year 2020. The university, as a whole, has a long-standing successful record of students participating in study abroad programs. Traditionally, students in engineering have been limited in opportunities to participate in international experiences. This is compounded by the fact that engineering students are reluctant to study abroad because it is difficult to receive credit, and the curriculum is tightly bound around a near century-old mandatory co-op program. Courses are offered only within certain semesters based on discipline, thus complicating any student's accessibility to international activities. Expanding the study abroad program to incorporate engineering students is a logical first step to executing an internationalization initiative. Having a highly-ranked regional engineering program, it is essential to expand global affordances beyond our borders and embrace internationalization.

Broadening global program options to include engineering initiatives provides a significant opportunity to increase a student's career decision and prepare them to enter a global workforce. For the University of Louisville engineering students, the development of a Global Engineering Track will serve as the cornerstone to address the limited international exposure engineering students have had in the past.
One such program is a Global Engineering Track that embeds four culturally centered activities defined as cultural intersections into a mandatory cooperative education

program. The track offers multiple global experiences and activities that provide engineering students an opportunity to gain cultural competencies to meet employer expectations for engineering jobs. Education abroad, foreign language programs, international internships, study abroad, international service-learning, and academic international partnerships are all paths of how an institution can integrate cultural aspects into teaching and research as internationalization of curriculum (Deardorff, Wit, Heyl, & Adams, 2012; Jibeen & Khan, 2015).

This action research study reviews educational frameworks and outcomes surrounding engineering education abroad that address higher education's instructional crossroads towards internationalization. According to Ramirez (2013), education abroad can have the strongest potential to shape the next generation of global engineering students through collaborative and communication skills aimed at bridging global differences and boundaries.

The Global Engineering Track integrating experiential education into its program in the form of education abroad as this type of immersive learning can create the most transformative impact on the development of global citizenship identity (Kishino & Takahashi, 2019). One form of experiential education is a short-term study abroad option. Short-term study abroad is an attractive pathway for engineering students to gain global citizenship as it is more affordable than a semester abroad, is easily structured into the curriculum, and provides a safe initial exposure to another culture (Donnelly-Smith, 2009; Gaia & College, 2015; Mills et al., 2010). International affordances, such as short-term study abroad as experiential education,

have the most impactful potential to shape the next generation of engineering student's collaborative and communication skills that will empower them to reach across global differences and boundaries (Ramírez, 2013). Downey et al. (2006) point out that the form of immersion removes students from their comfort zone and places them in unfamiliar circumstances long term, and builds the highest-profile of global competency.

Participating in cultural intersections promotes global citizenship and allows students to become authentic in the process as lived experiences are merged with evolving perspectives (Rickly-Boyd, 2015). This type of conceptual framework informs the structure of a new Spectrum of Intercultural Development (SID) built around a spectrum of perspective changes in curriculum, co-curriculum, experiential education, and critical reflection in the Global Engineering Track. These cultural flows of activities not only offer needed affordances towards global engineering for students but also promote the maturing of an interculturally 'authentic' engineering graduate using meaning-making experiences for self-authorship and maturing.

When aligned with intentional internationalized learning objectives, participation in the track promotes a student's understanding of self to understanding others and can alter an engineering student's perspective through direct participation in multiple dimensions of development (Davis et al., 2018). Participation across the spectrum of activities then not only actualizes intercultural knowledge but equally fosters values of cultural dispositions and personal development ("Intercultural Understanding" n.d.).

This capstone posits that a global engineering track can be seen as an activity-based model using structured affordances to develop an authentic ideal global graduate (Lilley, Barker, & Harris, 2015). Mezirow's transformational learning theory (Mezirow, 1991), Kolb's experiential learning theory (Healey & Jenkins, 2000), and Dewey's experiential education theory (Knobloch, 2003) were examined as a theoretical framework for a developmental model that informs how engineering students gain intercultural authenticity in a global engineering track. This capstone investigated activities, experiences, and processes held in cultural intersections of curriculum, co-curriculum, experiential education, and critical reflection. The global engineering track was examined as a primary consideration and means of understanding how internationalization of curriculum can potentially produce interculturally authentic engineering students who can graduate and work in an evolving global market.

What is the core of the capstone?

In collaboration with the University of Louisville, JB School of Engineering, and the person acting as the coordinator for engineering education abroad experiences, this researcher proposes that the purpose of this capstone is: (a) to examine why engineering in higher education needs to embrace internationalization of curriculum; (b) to examine how a global engineering track can be embedded into an engineering curriculum that requires mandatory cooperative education; (c) to explore short-term study abroad as a solution in internationalization of curriculum in engineering (d) and, to examine identity work, meaning-making, self-authorship and

existentialism as outcomes towards the development of one's intercultural authenticity in engineering students.

The transformational learning theories of Mezirow, Kolb, and Dewey (Katula & Threnhauser, 1999; Knobloch, 2003; Mezirow, 1991; Pagano & Roselle, 2009) along with the Developmental Model of Intercultural Sensitivity (Bennett, 2017) form the theoretical framework for this capstone. The theories and model reviewed construct the basis as to how outcomes from a Global Engineering Track can impact intercultural authenticity and examines how international affordances such as study abroad play a pivotal role in student transformative learning.

This Action research study draws upon an examination of a Global Engineering Track in a mandatory cooperative education program at the University of Louisville, JB School of Engineering, and illuminates how the program was structured. The approach positions how this form of internationalization of curriculum becomes associated with specific outcomes, benefits, and transformational change in students who participate in global education.

Who is the capstone meant to impact?

Developing an authentic global engineering student is a fluid process and requires higher education to provide affordances of global opportunities. Parkinson (2007) broadly summarizes the problem in engineering by asserting that in order to be competitive in the global engineering community, engineering students must be familiar with other cultures and countries. Increasing the number of engineering students who participate in global affordances through the process of

internationalization of curriculum is difficult. First, engineering students enrolled at an institution that embeds mandatory cooperative education in a year-round engineering curriculum have little to no opportunity to participate in a global experience without extending their time to degree. Second, structured global affordances such as study abroad are limited in pathways for engineering students due to a tight curriculum.

There remains a need for global programs that support engineering education abroad and produce outcomes aiming towards framing authentic intercultural development without replacing core engineering content. It is the opinion of this researcher that engineering schools should look to this capstone as a model towards internationalizing their curriculum and producing authentic global engineering students within curricular and time constraints. Despite a call from employers and society to higher education to internationalize their curriculum, engineering students are still less likely to be able to participate in international programs than their counterparts in science and math majors (Yu, 2012).

Accordingly, engineering schools should ensure that graduates will emerge with the cultural competencies needed to adopt and apply nonconforming global engineering perspectives. A key outcome should be to develop a program in which graduates can learn to accept and adopt other cultural ‘ways of knowing’ of engineering practices; equally important, they should ensure intercultural knowledge is gained from education abroad experiences through which learners gain the ability and objectiveness to assume other perspectives (Svensson & Wihlborg, 2010).

Across higher education programs, internationalization of curriculum in engineering is taking place but at a slow pace in engineering, as programs take aim towards promoting global citizenship. This internationalization is an important step in engineering as developing a global citizen requires one to not only understand others but to have a "sense of their own role as a world citizen" (Clifford & Montgomery, 2015, p. 50) and to align changes in their global perspectives through education abroad. Travels through education abroad programs, formal curriculum, and co-curricular activities are where students' have an opportunity to gain understanding and enhance global citizenship (Tyran, 2017). Unfortunately, engineering student's exposure to most international experiences is inhibited due to constraints in the curriculum, limiting their cultural perspectives and real-world lived experiences.

This type of programmatic investment is not a short-term strategy, nor can it be generated without key strategic attributes. Dedicated international curriculum, an alliance with interdisciplinary programs, strong and regular program evaluation, and well-conceived global learning outcomes must be attached to specific activities. One significant problem with the traditional framework of developing global engineering graduates is a genuine commitment to implement a curriculum in which aspects of global or intercultural knowledge are embedded into the learning objectives whereby all students can become candidates for global citizenship. Ramirez (2013) sees the importance of this candidacy, noting that "global citizenship is particularly salient: relating with other cultures in ways that are constructive and positive" (p. 2). This sort of salience requires a learning organization to which everyone from faculty to staff to

students contributes, as well as advocates, for global affordances and academics that are focused on teaching students to learn to “respect different cultures and people of different backgrounds” (p. 2).

There are exemplary global engineering programs in place that are considered leaders among engineering programs with and without mandatory cooperative education that unpack intercultural outcomes. As an example, the University of Cincinnati combines academics with study abroad and embeds a foreign language into a five-year engineering degree. One of the more robust global engineering programs is at the University of Rhode Island where approximately 20% of engineering undergraduate students perform study abroad. A framework in which global learning has application beyond traditional curricula and classrooms will allow students to critically explore the true meaning and practice of global learning and its outcomes (Kahn & Agnew, 2017). Even though the institutions may have different frameworks, a common core of approaches includes elements of the curriculum, co-curriculum, experiential education, and critical reflection towards the internationalization of curriculum.

How was this capstone project implemented?

In harvesting resources to build permanent levels of capacity for growing new engineering education abroad programs, institutions should consider how much and what type of adequate investment will be made or needed in order to support the development of global engineering graduates. This researcher suggests that in order for an institution to anchor a global engineering program into their school, they must

extend the adoption of internationalization of their curriculum both deep and wide, from leadership to agents of change. Institutions should look to develop levels of sustainability in their programs and gain buy-in of stakeholders in order to ensure the program survives unanticipated challenges during dips in development.

The internationalization of curriculum in engineering programs should be viewed as a commodity as it represents a measurable outcome that is highly valued, yet often elusive, due to the demanding engineering course schedules. As the global engineering program begins to mature from a planning stage to implementation, the value of internationalization should see an upward trend when student participation in global programs gains momentum. The more affordances are given to students to perform global engineering education, the more authentic and embedded the programs become into the culture of the institution.

When developing a global engineering track to internationalize the curriculum, considering how business schools embrace education abroad is vital. Business schools, much like the field of engineering, cannot afford to ignore the need to produce globally competitive graduates and internationalize their curriculum (Shetty & Rudell, 2002). The internationalization of the engineering curriculum is complex. It requires different strategies based on a school's internationalization plan, level of resources, and diffusion of the innovation. As a framework for the Global Engineering Track, this capstone examined Shetty and Rudell's (2002) research which suggested that schools should include the following in a global program development plan:

- A mission statement that identifies an internationalization goal;
- An organizational structure that outlines how education will be internationalized;
- The internationalization of curriculum; and
- The internationalization of students.

Accordingly, the following framework was considered and adopted into the strategic plan when developing the Global Engineering Track:

Mission Statement. Redefine our boundaries on a global scale, and leverage our institutional strengths towards educating a culturally and socially responsible engineer who can solve complex global problems and challenges in the 21st century.

Organizational Structure of the Track. The Global Engineering Track will act as a conduit towards transforming cultural perspectives and gaining intercultural authenticity. The track will introduce students to dimensions of engineering on a global scale through intentional, intensive, and immersive real-world experiences. There are many ways to gain international experiences in a mandatory cooperative education program. Global engineering opportunities should include international service-learning, short-term faculty-led study abroad, semester abroad, and internships abroad.

Students wanting to gain deeper cultural authenticity can participate in programs such as the Global Engineering Track. This track exposes students to structured globally-centered activities held across four platforms: curricular, co-curricular, experiential education, and critical reflection. Learning outcomes in each

platform develop intercultural knowledge and cultural skills towards becoming a more authentic global engineer. As students immerse themselves into a corresponding cultural experience or activity, their perspectives begin to change and are altered from prior stages, and solidified during the critical reflection stage.

Curriculum. Curriculum as an academic platform in the Global Engineering Track helps students become aware of inequalities and diversity on a global scale through academic courses. It anchors what Kishino and Takahashi (2019) see as a core opportunity for students to self-authorship their own global citizenship identity and foster an understanding of their social responsibility. Katula and Threnhauser (1999) caution that development using the platform of experiential education should not forget the impact of critical learning in the classroom. Accordingly, students in the track are required to pass a credit-bearing domestic or global diversity class-based course to fully broaden their understanding of cultural impacts on social and historical contexts.

Co-curriculum. Huang (2017) introduces a pragmatic approach towards the development of an activity-based program that promotes intercultural competence through co-curricular activities rather than pure traditional classroom teaching. Co-curricular activities, as defined by Huang (2017), represent those out-of-class activities that surround intercultural education. Activities can include but are not limited to, participating in an international festival, attending a foreign language debate, or an international symposium.

Kishino & Takahashi (2019) describe co-curricular cultural activities as being interactions that facilitate engagement within diverse student bodies and organizations. The interactions provide students with an understanding of local-global issues and promote learning outcomes that will increase a student's awareness of their individual biases while allowing them to embrace and value differences.

Experiential Education. Experiential education presents the most impactful type of transformation on the student's cultural perspective. The track uses three formats: study abroad (both semester-long and short-term), international service-learning, and international internships. All provide platforms from which students can develop intercultural competencies, but each one differs as to how the student gets exposed to the culture.

Critical Reflection. Critical reflection used in-class and in-country should be based on prompts that focus on relative content and introspective reflection. Faculty leading the reflection can help the students draw on a connection between the experience or activity and how each construct meaning for the student. Learning experiences allow students to construct meaning through critical reflection. Critical reflection provides students an opportunity to realize the inconsistencies held in their beliefs and act accordingly to restructure their assumptions concerning their world. Critical reflection is a process of changing our mind as we question held assumptions and beliefs; it is the most significant form of justifying our cultural limitations and reframing them to fit into our reference of the world (Mezirow, 1991; Taylor, 1998).

As students critically self-reflect while crossing through the global track's cultural intersections, perspective transformation occurs while shedding light on held differences of culture. Taylor (1998) sums up this praxis concept with the statement that "action happens in concert with reflection," meaning transformative learning can only happen through "the practice of critical reflection, problem-posing, and dialogue" (p. 18).

Critical reflection is a way for engineering students to view and understand the meaning-making process and its intended outcomes. Strands of student development theories from Freire, Daloz, and Mezirow provide concepts as to how engineering institutions should look to shape global programs, constructing learning around transformation as development, consciousness-raising, and with a perspective change in mind (Dirkx, 1998). According to (Gabowski, Wearing, Lyons, Tarrant, & Landon, 2017), reflection is the review of the "transformative experience that leads to a shift in one's perspective, awareness, and world-view" (p. 7). The authors further contend that short-term global affordances provide students the opportunity to grapple with, reframe and reflect on their experiences that lead to change. This view is supported by Mcneill and Cox (2011) who propose that programs should engage their students in active critical reflection to support learning outcomes and be a part of an internationalization strategy.

Students may have to participate in co-curricular activities and international service-learning before taking globally-focused curricular courses due to their academic plan or vice-versa. However, at some point, the student will cross through

all four of the cultural points in the Global Engineering Track and end up critically reviewing those experiences. Keep in mind that, individually, students will pass through the cultural intersections at varying rates and times in their approach towards becoming an authentic global engineering graduate.

Internationalization of Curriculum. One of the goals in program development was to create an awareness and appreciation for the need to internationalize the engineering curriculum. It is critical to have an awareness of changing culture in the school towards education abroad and find appreciation for its impact on student cultural outcomes. Parkinson (2007) urges colleges to have a suite of international programs from study abroad to programs that have no boundaries across the globe. The author acknowledges the demanding curricular in engineering and discards the requirement of a language component as it is often a barrier for engineering to participate in engineering education abroad. According to Parkinson (2007), a clear set of objectives should be in place as a prerequisite to determining the success of the program and whether or not the outcomes have been met. This objective-oriented approach Shetty and Rudell's (2002) study by adding to the program development plan in which the focus is on internationalization.

Internationalization of Students. Accordingly, the Global Engineering Track developed its own set of objectives that were based on specific outcomes from Brigham Young's program (Parkinson, 2007):

Students will:

1. Understand issues in engineering associated with global product development in different cultures and appreciate different approaches taken in product development needed to solve complex engineering problems.
2. Understand design strategies associated with the concept, engineering principles, developing products in a global environment, and prototyping with differing cultural structures and ways of knowing in mind.
3. Understand the challenges engineering faces in resolving issues across different countries and cultures, and understanding what processes are needed to address these challenges from an engineering standpoint.

The infusion of international perspectives through culturally themed lectures, cases, readings, and assignments is the most impactful method of developing international awareness and understanding (Shetty & Rudell, 2002).

Application for Other Engineering Schools. Although mandatory cooperative education in engineering is limited to a handful of institutions, some applications of this Action research study are fundamental components that can be considered across any internationalization strategy in engineering. To begin, engineering schools should recognize that globalization demands engineering schools to internationalize their curriculum, and do so with a sense of urgency as the pipeline of engineering is declining (Johnson & Jones, 2006). Second, engineering schools need to ensure that there are awareness and an understanding of how courses and programs can be infused with cultural components.

According to Parkinson (2007), engineering schools must proactively develop global programs that are not only attractive to students but that convince them that international education is part of academic education and "a critical element of their education" (p. 10). Parkinson provides best practices examples that call for 1) using students who have traveled before to champion and recruit new students, 2) using industrial advisory boards to diffuse the innovation of education abroad among employers, and 3) using student advising as an initial recruiting point as they can encourage early planning and entry into global programs.

The Global Engineering Track adheres to these best practices as a Global Teaching Assistant position was developed as an inroad for students to become ambassadors of the global program and travel on faculty-led study abroad trips. Second, the Global Engineering Track was introduced to employers to share our common vision that graduate holds global citizenship. Finally, the Global Engineering Track embedded its program introduction into new student orientation and Freshman Fundamentals courses in collaboration with Academic Advising with the task of reaching students early in their curriculum planning stages. The program is based on the expectation that the learner critically considers and propose global solutions based on newfound engineering knowledge and competencies.

Institutional Capacity and Opportunities for Growth. From 2012 - 2020, only 24 undergraduate JB Speed School of Engineering students have participated in international internship activities. The number of international electives has increased slightly this past year with the development of two faculty-led study abroad

opportunities in Peru and China. Through an IES Abroad Grant, JB Speed students were afforded the opportunity to expand their international experience in China, where there were no opportunities for engineering students. Given today's economic market as engineers, students at the JB Speed School of Engineering must have additional international opportunities that can truly provide them with cross-cultural experience and language exposure.

Monitoring and Evaluation. Huang (2017b) emphasizes the importance of performing formative and summative evaluations of program models. This evaluation is completed in the track to ensure desired certified cultural outcomes and adequate progress in learning. The Program Coordinator from the JB Speed School of Engineering will be in charge of the monitoring and evaluation process of the Global Engineering Track. In order to best manage this new program, the engineering school proposes an application process for engineering students seeking to travel abroad and participate in the track. International IQ measurements will be put into place to monitor student readiness. This process will also allow the school to gather information on participants and track the level of interest through the years by the number of applications received. Quarterly reports will be prepared and disseminated to highlight student activities and international expenditures.

Secondary, participant numbers will be verified through the International Office and registration records, as each participant will receive academic credit for their experience in the track. Additional indicators of success will include feedback from faculty, as well as the students' experience. Each student will complete a co-

op/intern report at the end of their semester-long study- abroad experience, which will be reviewed by a faculty member from the student's department to identify if the experience met ABET accreditation and academic criteria. This report will serve as a student's reflection on their experiential education.

Sustainability Plan. To develop a level of sustainability, the Dean of the JB Speed School of Engineering has agreed to support a scholarship program called Global Engineers, which will offer one-time scholarships for up to $1,000 each, with a minimum of three scholarships available per year. The exchange program will be administered through the Engineering Cooperative Education and Career Development Office. Participating students must be enrolled in the Global Engineering Track at the University of Louisville, have a minimum GPA of 3.0, and be in good academic standing. In addition, to participate, students must have completed at least two of the three required co-op rotations or be eligible for advanced standing for two rotations. Preference will be given to students who are not native speakers of the language spoken in the country or region to which they intend to travel.

Students will complete a formal application to participate and a committee will choose the top 3-5 students to receive funding. The Dean will also work with our Development Office to identify potential donors that might have an interest in expanding international opportunities for JB Speed School students. Ultimately, the goal is to develop enough student interest that the global affordances can be replicated to incorporate further opportunities in other countries.

Challenges of Change in Culture. Historically, only a small number of undergraduate engineering students have been able to participate in international education. In 2020, the university averaged 2,000 students in class across all majors and years of study. Of those, 84% of the 2013 freshman class came from the state of Kentucky, and upon graduation, approximately 74% of the graduates will accept a position within the region and never work or travel abroad. Using elements of experiential education for program participation, students in the track are able to engage in global engineering learning experiences that will enhance their ability to travel abroad, be employed internationally, and gain intercultural competencies. Part of the global track and internationalization initiative is to change the "domestic career" culture and provide pathways for engineering students to obtain an education abroad experience.

Global affordances expand an engineering student's cultural capital in real-world settings beyond the classroom and provide opportunities for engineering students to travel abroad. That challenge is finding room in an engineering curriculum whereby students can participate in global affordances without extending their time to degree. Bringle and Hatcher (2011) best define global affordances as a service in the track that offers "a course-based, credit-bearing, educational experience in which students (a) participate in an organized activity that meets identified community needs, and (b) reflect on the service activity in such a way as to gain further understanding of course content … an enhanced sense of personal values and civic responsibility" (p. 112).

Two major constraints prohibit engineering students from participating in the track. First, many students lack the funding necessary to attend a semester-long internship/study abroad program. There are very limited scholarships and students would need to take 6 credit hours to be eligible for federal financial aid. Without financial assistance, most students would not be able to participate. The second constraint is that students must overcome the inflexibility of the engineering curriculum and the mandatory co-op program. While there is much student enthusiasm for international experiences, lack of approved opportunities and scheduling conflicts prohibit students from taking advantage of international experiences. The confluence of a co-op within the global engineering track will alleviate these constraints.

Strategies to Overcome Challenges of Change. Developing an authentic global engineering student is a fluid process and requires the affordances of global opportunities. Engineering students enrolled at an institution that embeds mandatory cooperative education in a year-round engineering curriculum have little to no opportunity to participate in a global experience without extending their time to degree. The central tenant of this action research study is the development of a Global Engineering Track that provides intentional and structured global opportunities without extending time to a degree beyond four years.

One core experiential education offered in the program is the ability to substitute a mandatory co-op rotation with a semester-long study abroad. This is a

culture change as engineering students have not had global affordances made available in attempts to internationalize their curriculum.

The challenge facing engineering students, according to Blumenthal and Grothus (2008), is fitting in a semester abroad in a tight engineering curriculum, even more so when mandatory cooperative education is involved. The Global Engineering Track faces the challenge of changing a 95-year-old culture where international education has not been a part of the curriculum; as such, programs were not formally developed to house education abroad. As such, institutions trying to build a case for driving change in their education abroad strategies should look at aligning cultural intersections with related learning outcomes. These outcomes should not only produce desired cultural capital but should leverage intercultural knowledge from lived experiences towards developing high-performing global citizens.

At the heart of this strategy is having a track that not only closes the barriers that engineering students face in pursuing education abroad, but that is pragmatic in its efforts while empowering the ideas of internationalization. The Global Engineering Track is seen as evolutionary; it requires resources, administration, and capacities to develop global engineers. This solution can only come about through the strategic diffusion of an innovative global track that lives in a mandatory cooperative engineering education curriculum. In its change efforts, the track also has reiterated its larger sense of meaning, one that holistically adds value along multiple cultural stages which plays a role in developing an authentic global engineering graduate.

Why were this capstone and related strategies selected?

International Engineering Education Models. This researcher examined a Global Engineering Track as an international engineering education model for developing outcomes of intercultural authenticity in engineering students. The track format offers an opportunity for engineering students to participate in international engineering education despite the constraints of a mandatory cooperative education program. In examining engineering education abroad programs across other engineering schools with global components, a mix of the common core curriculum, activity-based experiences and education abroad approaches were found that share similarities with the Global Engineering Track. Since the track is still in its infancy stages, almost all of the programs examined represented a wider spectrum of global opportunities and were more comprehensive in scope.

In 2007, Parkinson reported a survey of engineering study abroad programs already in place that focus on the type of programs and best practices. Huang (2017) adds to this study by proposing a four-model pattern of co-curricular activity-based stages towards intercultural competence. Shuman, Besterfield-Sacre, and McGourty (2005) argue that design projects need to be a part of a global program model in order to encourage the teaching of professional skills while still reinforcing core technical engineering skills. A review of exemplary study abroad and global programs by Parkinson (2007), as well as a review of leading engineering programs with mandatory cooperative education revealed linear approaches towards the internationalization of curriculum exists in program structures.

It is important to acknowledge that ABET engineering criteria for accreditation direct engineering schools to require engineering students to have a broad understanding surrounding the impact of engineering solutions in a global context. This requirement was first introduced in 1997 and is outlined in ABET Criterion 3, outcomes 1-7. Table 1 presents a categorization of global engineering programs (Parkinson, 2007; Shuman et al., 2005) that connect ABET professional skills with global context and center them on four stages of curriculum (CU), co-curriculum (CC), experiential education (EE), and critical reflection (CR) in the Global Engineering Track. Even though most programs have a wide variety of requirements, all do provide outcomes of global orientation across at least one and even multiple cultural intersections in some format or title.

Table 1

Comparison of International Engineering Education Program Models and Learning Formats

Institution	Program	Format
University of Louisville	Global Engineering Track	CU-CC-EE-CR
University of Rhode Island	International Engineering Program	CU-CC-EE-CR
Lehigh University	Global Citizen Backpack Program	CU-CC-EE-CR
Purdue University	Global Engineering Minor (GEARE)	CU-CC-EE-CR
University of Cincinnati	Joint Engineering Co-op Institute	CU-CC-EE-CR
Duke University	Global Development Certificate	CU-EE-CR
Worcester Polytechnic	Interactive Qualifying Project	CU-CR
University of Colorado	Global + Co-op Track	CU-EE
Georgia Tech	Minor in Leadership Studies	CU-EE
University of Michigan	International Programs in Engineering	CU-EE

University of Pittsburgh	Plus 3	CU
Stanford University	Global Engineering Program	EE

The programs reviewed have internationalized their curriculum in formats similar to the Global Engineering Track in that they rely on a multitude of formats of study abroad, global internships, extended field-trips abroad, and international competencies to foster intercultural awareness in order to change engineering student's cultural perspectives. Shuman et al., (2005) present in their research the University of Rhode Island as a proto-type model for integrating the international experience into a five-year engineering education degree. The model is innovative, as it combines engineering with a language degree centered on a global and social context. Their program, like many others examined, does not have the challenge of embedding mandatory cooperative education into their academic semester rotations which leaves room for a broader spectrum of program types and participation.

Internationalization of Curriculum. The internationalization of curriculum is not a new concept in higher education. It has been a strategy dating back as far as the 16th century as a way to preserve cultural and diverse dignity while preparing students for a global world and a society of multiculturalism (Clifford & Montgomery, 2015; Grainger et al., 2015; Leask, 2013). The internationalization of curriculum is broad in scope, lacking clarity in definition, and presents multiple challenges being integrated into the engineering curriculum. In the U.S., internationalization of the curriculum towards graduating globally competent students is taking place, but slowly, particularly in engineering. This slow pace presents a

complex formula for institutions seeking to design course content and program affordances in engineering to promote what Bennet called “global souls” (as cited in Wagenaar & Subedi, 1996, p. 72).

According to Deardorff et al. (2012), the context for defining internationalization of curriculum centers around the ability to provide content and experiences that engage students towards thinking about how a global environment requires global thought in order to develop international perspectives. The authors define the role internationalization of curriculum as holding “interest in producing globally competent graduates capable of understanding and functioning in a complex and interconnected world” (p. 6). The internationalization of curriculum requires integrating, rather than adding, new content in the attempt to embed international perspectives, ideologies, and processes into the curriculum. Institutions are held accountable for the internationalization of curriculum as they look for ways to embed culturally centered activities and global experiences into an already tight engineering curriculum.

With this need in mind, Tarrant, Rubin, and Stoner (2014) argue that it is an inherent responsibility of higher education to ensure that internationalization of curriculum takes place in order to foster global citizenship, improve employment opportunities, and heed the call and importance of graduating globally-minded students. Durbin agrees (as cited in Tarrant, Rubin, and Stoner, 2014) that “it is the responsibility of the American educational system to engage students in global education” (p. 142). Lilley, Barker, and Harris (2017) add that universities are

responsible for educating and graduating socially responsible global citizens, while Patel and Lynch (2013) contend that higher education "must take responsibility for providing potential graduates with opportunities to become active citizens in a turbulent global economy" (p. 225).

Importance in Engineering. Internationalization is a challenging process in engineering, but it is necessary to respond to the effects of globalization (Deardorff et al., 2012). Globalization, as defined by Raby (2007), is a process of transforming the views of students to those that appreciate unique cultures. The author postulates that the development of literacy is pragmatic in nature and should include a context for learning wherein people "begin to think international and intercultural terms" and this development should be used as a pedagogical form to prepare graduates to "live, work and transact in our global world" (p. 58). Madeline Green offered several reasons as to institutional responsibilities for internationalization which include preparation for global citizenship and workforce, enhancing institutional prestige, generate revenue, and therein increase in international understanding (Roberts, 2015).

According to Clifford and Montgomery (2015), the internationalization of curriculum in the form of short-term study abroad can be used to promote self-understanding while leading to changes in one's perception towards others' beliefs and behaviors. Arising from intentional purposeful experiences, meaning-making as a domain of existentialism provides a way for one to challenge perspectives, reframe assumptions, and transcend considerations of culture and social justice. Meaning-making is important to understand as it is a key outcome in the process of change in

the Global Engineering Track due to its use of critical reflection to promote "sociocultural readiness" in students and stakeholders alike towards becoming a global citizen.

The Oxfam Development Education Program presents a definition of global citizenship. They delineate the traits of a global citizen as:

> someone who is aware that they play a role as a citizen in the world, places value in diversity, understands that external factors (economics, politics, etc.) play a role in how the world works, participates in the world, and seeks to both understand and be held accountable for their actions. (Oxley & Morris, 2017)

This definition parallels what the Global Engineering Track deems as reconceptualizing the outcomes of learning through transformative learning. Deardorff et al. (2012) contend that internationalization is used to educate students towards being able to function in a globally integrated economy and needs to be used to develop global citizenship with a lens aimed at adjusting cultural perspectives. The track provides a pathway for students to participate in global activities such as studying abroad, international service-learning, foreign language, and international degree programs that lead to the development of a global citizenship lens.

Partnerships abroad are another form of internationalization and require a commitment to all parties, being grounded in social justice and towards the improvement of educational opportunities for all students. Social justice should be seen as a moral attempt to shape equality within a social context in education abroad,

as it moves perspectives across cultures. Roberts (2015) points out that "in partnerships where the host culture has different standards of hospitality or luxury, it is very important that facilities and programs reflect the sensibility of the local environment" (p. 13). This distinction expresses how good stewardship of resources needs to be addressed when internationalizing the curriculum and how the environment of the program can influence a partnership model.

Of course, the need for internationalization of curriculum in engineering is not self-evident, and the question of why this shift is crucial is important. Commander, Zhao, Gallagher, & You (2015) posit that "one reason internationalization of curriculum is especially important is the increasing demand for hiring individuals who can work with people from different cultures" (p. 365). This demand leans towards the development of intercultural competencies that include an understanding of globalized perspectives and relevant real-life experiences. However, building a globally responsible academic curriculum can be challenging as higher education has been slow to respond to the call. Clifford and Montgomery (2015) assert that the internationalization of higher education at most universities is slowly beginning to adopt change. Institutions are becoming committed to global citizenship using pedagogic approaches in the curriculum that include study abroad and a departure from ineffective ethnocentric models of learning.

The centrality and importance of internationalization of curriculum within higher education arrive as a response to the globalization of society, as well as an avenue to help centralize international perspectives towards new teaching and

learning approaches. There are many pedagogical models that can be used towards the internationalization of the curriculum. Global academic programs, international internships, study abroad (short-term and semester), international service-learning, and academic international partnerships are all aspects of how an institution can integrate cultural aspects into teaching, learning, and research (Deardorff et al., 2012; Jibeen & Khan, 2015).

One approach piloted at the University of Louisville, JB Speed School of Engineering was a Global Engineering Track. This track is framed around a mandatory cooperative education curriculum that requires students to participate in three semesters of cooperative education, rotating academics, and cooperative education each semester. As a form of internationalizing the curriculum, engineering students in the track can substitute one of the mandatory cooperative education semesters with a semester abroad.

New initiatives like the Global Engineering Track are aiming at developing intercultural competent graduates. This development occurs despite the contexts of mandatory cooperative education. Regardless, this push for intercultural competency is an important step for engineering schools, as developing globally minded students requires them to not only understand others but have a "sense of their own role as a world citizen" (Clifford & Montgomery, 2014, p. 50). This shift requires changes in global perspectives through experiential education and globally focused activities such as study abroad. Tyran (2017) concluded that travels through education abroad programs, formalized curriculum, and co-curriculum activities assist students in

gaining understanding and enhancing global citizenship. Unfortunately, many engineering graduates rarely have sufficient exposure to international experiences. Limited engineering global perspectives and a lack of real-world experiences justify a reason for the internationalization of curriculum to take place.

Internationalization of higher education has become a commodity as university rankings and the recruitment of international students act as a means to generate revenue rather than educate (Svensson & Wihlborg, 2010). Svensson and Wihlborg (2010) further note that the curriculum has been piecemealed to reflect internationalization in what is referred to as an "infusion approach." This approach takes place when institutions begin integrating curriculum into their institution's program. Two options, at-home, and cross-border internationalization illuminate how institutions can become engaged in international education. Jibeen and Khan (2015) consider internationalization as a form of exchange between those who know and those who seek knowledge using international educative initiatives.

Internationalization in higher education can include globally-focused curricular and co-curricular activities. Internationalization can also include global affordances such as study abroad, international internships, and global research. Jibeen and Khan (2015) consider these formats a global trend in which an exchange takes place through agreements and collaborative efforts between universities. In an effort to internationalize curriculum in education, strategies should include on-campus and off-campus activities that infuse cross-cultural concepts, theories, and global perspectives into their academic programs (Raby, 2007).

Partnerships aid in the development, planning, implementation and the advancement of internationalization initiatives. Tim Gore, author of "Higher Education Across Borders: Models of Engagement and Lessons from Corporate Strategy" (2012), proposes a partnership model that includes efforts such as cultivating shared purposes, preserving brand (institutional) identity, development of sensitivity towards cultural awareness, and other implementation efforts (Roberts, 2015, pp. 11-12). It is with these goals that programs should first partner with other resources, and then build on those programs towards a more university-specific internationalized program. Within the Global Engineering Track, partnerships with third-party providers of education abroad were seen as foundational in launching the program as the burden of logistics was removed and the focus on engineering global curriculum content took center stage.

The internationalization of curriculum requires faculty support as they determine the curriculum and how their teaching efforts embed engaging activities from an "interdisciplinary and integrative stance" towards internationalization (Deardorff et al., 2012, p. 250). The Global Engineering Track engaged faculty by allowing them to participate with students on study abroad and international service-learning experiences, The faculty, staff, and educators' efforts towards building out global programs in higher education reflect an 'authentic internationalism' approach and are used to advance cultural awareness in students (Raby, 2007; Roberts, 2015).

Challenges to Internationalizing the Curriculum. Internationalizing the curriculum in higher education doesn't exist without concerns or challenges.

McDermott (1998) and Roberts (2015) assert that there is a question of balance needed between incorporating new material in the curriculum without marginalizing the content. The author presents several concerns such as using post-colonial theoretical and experiential perspectives as a way to control content in classrooms; using a context of each author's voice with intersections between race, class, ethnicity, sexuality, religion, language, and nation; the historicizing of accounts of experiences and ways of learning from them; and finally, finding a way to highlight and frame comparative international materials without duplicating colonial relationships or recreating a form of colonialization as seen in a historical context.

McDermott (1998) insists that international programs need to be considered as a part of the required curriculum which "embodies the fundamental, shared intellectual and political tenets" that articulate the core required courses and "anchors a field of study" (p. 92). Jibeen and Khan (2015) agree and consider the scope not only to range from those types of programs but also include taking courses at other universities in other countries (study abroad), potentially through branch locations abroad that promote and provide access to culturally diversified academics.

Tarrant (as reported in Mills et al., 2010) claims that "the future workforce of America depends on a citizenry that is sensitive to, and aware of, global issues" (p. 433). There is a profound impact that is derived from this statement as politics, innovation, economics, and culture shapes the lives of students (McDermott, 1998; Roberts, 2015). To address this shift, higher education needs to address globalization through the internationalization of curriculum and allow cross-cultural exposure to

their students. This exposure and intentionality will provide an awareness of other societies, cultures, beliefs, and ways of knowing, that are outside of the scope of one's held philosophies or society itself. The justification for the track paradigm shifts is intentional: Internationalization of the curriculum is formed by advocates of global citizenship, institutional strategies, and partnership programs towards the development of robust international experiences.

Globalization has many faces in society, but it manifests in the way of proliferating economies, embodying communities, markets, rural and urban areas, crossing boundaries towards regulating the flow of money, people, goods and service (Svensson & Wihlborg, 2010). According to Roberts (2015), globalization is an economic phenomenon that crosses borders and affects each country differently based on domains of culture, history, or tradition. Institutions can begin to learn this definition as they form standards for the internationalization of curriculum. Understanding globalization provides a subdomain for understanding how program development needs to surround the way humans communicate and exchange information or knowledge.

In the efforts to internationalize the curriculum, however, caution must be extended to ensure that the intentions are academically aimed, such that universities who expand beyond national borders are not seen as colonizing education in regards to curriculum, programs, and faculty (Jibeen & Khan, 2015). The Global Engineering Track addressed this concern through the use of third-party global education providers for short-term faculty-led study abroad programs. It is prudent and

responsible for the track and providers to continue to assess and examine the effects of internationalization of curriculum while ensuring policies and programs are in place to monitor levels of cultural identity associated with the internationalization of higher education. The pedagogical approaches used in implementing the internationalization of curriculum become key determinants of how successful either on-campus or off-campus initiatives deliver inclusion of internationalized programs in anchoring core curriculum or programs like the engineering track.

However, the challenge for higher education lies in the different institutional contexts, program structures, and class compositions that present variances in how to transform the institutional curriculum. Equally important to note is that there is a paucity of literature on how internationalization of curriculum can be embedded into the contexts of engineering programs that have mandatory cooperative education (Clifford & Montgomery, 2015; McDermott, 1998).

When put in place, the internationalization of curriculum as a strategy produces a philosophical shift in a learner's perspective when used as a transformative learning approach. As universities begin to add programs to internationalize their curriculum, specifically in engineering global program development, the intentional outcome is often that of creating intercultural authenticity in students who participate in the programs.

Fostering Authenticity in Program Outcomes. One of the overarching anticipated goals of the Global Engineering Track was to provide engineering students with an opportunity to participate in education abroad. The development of

intercultural competencies in students should be included as part of the anticipated outcomes from programs aimed at internationalizing curriculum at institutions (Huang, 2017). Utilizing structured experiences and activities, the objective was to develop engineering students who become an ethically thinking global graduate (Lilley et al., 2017). The entry points as cultural intersections represent what is described in Kolb's experiential learning cycle as stages in distinct learning styles as alternative pedagogical approaches can tie the experiences and critical reflection to student learning (Healey & Jenkins, 2000). Careful consideration was given as to how the program was embedded into the mandatory co-op program as there is little room in engineering to broaden the curriculum spectrum (Clifford & Montgomery, 2015).

The track does not see these outcomes as being monolithic, but rather one in which students become intertwined into global exercises that allow them to intrinsically move towards global authenticity. Lilly et al. (2017) argue that becoming globally authentic is complex and that multiple variables play a role in being intercultural citizenship, noting that participation towards becoming a global citizen is fluid. The Global Engineering Track sought to have program outcomes include cross-cultural competencies developed through *meaning-making* experiences and *existential* identities found through experiences during *self-authorship*. Clifford and Montgomery (2015) noted the outcome for students is to aim to "live the course rather than endure it" which gives way to forms of *identity work* and disruption of the typical curriculum model for engineering programs to the "reconceptualization of the whole curriculum" (p. 54) towards embracing the need for a global engineering track.

Self-authorship. Barber and King (2014) present research that attributes the extent to which experiences have the ability to enable developmental growth (meaning-making) and can lead to self-authorship. Three themes were uncovered by the authors which actually impact experiences and produce self-authorship. The most overarching theme found was the "exposure to new ideas, beliefs, cultural backgrounds, or unfamiliar situations that challenged student's conceptions of the world and their place in it" (Barber & King, 2014, p. 440) within the experiences promoting self-authorship. This experience-based challenge is crucial as it validates how crossing multiple cultural intersections provide opportunities to expose and challenge engineering students and the cultural perspectives held. As engineering students are exposed to DEE in a global track or program, they begin to develop traits of self-authorship with movement in culturalization and change in perspectives. Global engineering DEE constructs new meaning-making held in critical reflection, where a subjective sense of purpose is demonstrated (Park, 2014).

Developmentally effective experiences (DEE), as described by Barber and King (2014), are experiences that promote two types of existential authenticity: meaning-making and self-authorship, both of which can be delivered through experiential education programs. Abes and Hernandez (2011) add that self-authorship facilitates the new knowledge gained from experiences because "self-authorship depends on students seeing themselves as knowers" (p. 98) in order to become authentic. Baxter Magolda (2009) postulated self-authorship as a form of

"understanding and owning one's views and decisions" (p. 434), which often leads to the capacity to construct different self-beliefs within oneself.

Identity Work. The outcomes from identity work (in activities performed in engineering abroad) include increased maturity, self-efficacy, and higher confidence levels (King, 2011). Wehlage et al. (as cited in Knobloch, 2003) maintain that one of the criteria determining authenticity in the activity is ensuring that "students should be challenged as to if they were in adult roles" (p. 23). Guided by the transformational learning theory developed by Mezirow (1991), the transformation seems to measure changes in perspectives and deep shifts in mental models towards the shaping of new perspectives. This change allows students to become their own author of knowledge, and improve their personal agency towards becoming more authentic in their self-perspective.

Identity work when defined as activities performed in meaning-making experiences such as short-term study abroad was found to increase maturity, self-efficacy, and higher confidence levels, allowing students the opportunity to emerge into an adult status, and, in the process, gain cultural and social identities (King, 2011). Mezirow's transformational theory of learning promotes an understanding of how transformational learning "holds that adult learners undergo a process of constructivist learning in which they experience deep shifts in their mental models, thereby coming to change perspective, become authors of their own knowledge, and increase personal agency" (Hendershot & Sperandio, 2009, p. 46).

With this concept and identity as a background, it then becomes much more important to internationalize the curriculum and provide engineering students with outcomes from experiences that produce deep-rooted transformational change. These changes are directed by fusing existentially authentic meaning-making moments in education abroad that promote learning outcomes enhancing personal qualities, problem-solving and communication skills, and self-interest much like in students who travel abroad during a gap year (Blackburn, Clark, & Pilgrim, 2005). Defining the perceived versus actual value and benefits of education abroad experiences for engineering students is complex. One needs to consider whether or not similar experiences are comparable in value and hold the promise of providing transformational activities towards self-development and new identities.

Meaning-making. According to Dirkx (1998), experiences from formal education foster transformational learning and play a crucial role in the meaning-making process. Clark and Wilson recognize this role in their discussion about Mezirow's transformative learning theory, in which they maintain that a contextualized view of rationality is needed to maintain a connection between those experiences and the actual meaning gained from them (Grainger et al., 2015). Mezirow's theory of transformative learning aims to inform curriculum development in terms of how students' view of the world and how meaning-making experiences shape their assumptions towards change (Grainger et al., 2015).

Fostering transformational change through engineering abroad programs then becomes an avenue for students to hold meaning from experiences, become self-

aware, create self-authorship, develop forms of global citizenship, and hopefully form intercultural authenticity. Jones, Rowan-Kenyon, Ireland, Niehaus, and Skendall (2012) draw upon Mezirow's transformational learning theory in order to assume that educational experiences change individual perspectives when they interpret the world. Having various combinations of global education experiences thus becomes more important as it provides engineering students with different learning avenues for change.

Park (2014) presents two levels of meaning-making which allow one to make meaning of a specific moment, or situation, and then comprise a review of the situation, followed by a revision of the view; eventually, one makes new meanings of the outcomes from the experience. Park maintains that meaning-making involves the way one seeks to understand their own experience and the implications it has on them. Given this bifold understanding, one can draw conclusions about how meaning-making can bridge education abroad experiences with elements of existentialism by allowing students to fully understand their experiences and its implications.

It is the experiences that hold developmental impact and construct meaning-making, which, according to Park, allows a subjective sense of purpose to be demonstrated. This is a common thread among volunteer tourism experiences abroad and has equal associations within existentially authentic characteristics (Barber & King, 2014; Kirillova et al., 2017; Steiner & Reisinger, 2005).

Heidegger, as Steiner and Reisinger (2005) note, claims that authenticity is reached when "someone is being themselves existentially" and is "experience-

oriented" (p. 303) in a non-conforming sense. Experiential education, specifically in international service-learning and study abroad programs, holds valuable "authentic" transformational opportunities that involve meaning-making experiences, identity development, and the capacity to foster change towards personal growth, perspectives, long-held beliefs, and ethnocentric views. They form an existential experienced-based partnership that expands the boundaries of transformative learning towards change.

Accordingly, one could determine how meaning-making bridges education abroad experiences with self-authorship by allowing participants to fully understand their self (existentialism) and the implications of the experience. Experiences hold developmental impact and construct meaning-making. Jones, Rowan-Kenyon, Ireland, Niehaus, and Skendall, (2012) and (Park, 2014) add that meaning-making contributes to new understandings of self through reflection and allows a subjective sense of purpose to be demonstrated..

Existentialism. The essence of existentialism can produce desired changes in transformative experiences commonly seen in volunteer tourism by embedding the characteristics of meaning-making (Barber & King, 2014; Kirillova, Lehto, & Cai, 2017; Mayes, 2010; Steiner & Reisinger, 2005), self-authorship, identity work (Abes & Hernandez, 2011; Barber & King, 2014; Snee, 2014), self-development, and most importantly, forms of intercultural authenticity (King, 2013; Kirillova et al., 2017; Kontogeorgopoulos, 2017; Mayes, 2010; Steiner & Reisinger, 2005) to student aspirations. Gaining existential intercultural authenticity can be seen as taking an

activity-based philosophical approach to the understanding or meaning-making of one's cultural self. Activities found in forms of volunteer tourism (Kontogeorgopoulos, 2017; Rickly-Boyd, 2015; Steiner & Reisinger, 2005; Stoner et al., 2014) seem to parallel outcomes in education abroad.

A combination of the phenomenology of philosophy and existentialism is woven in the fabric of transformative experiences. Both act as catalysts for changes in perspectives and as a theoretical framework towards the understanding of individual lived experiences (Kirillova et al., 2017; Wang, 1999). The essence of existentialism, as it relates to education abroad experiences and human behavior, is found ingrained in the perceived benefits of touristic experiences. Jean-Paul Sartre, a highly-regarded existential philosopher, sees the construction of meaning as an act done by one's own self at a consciousness level. This point of construction is important to keep in mind as there is a paucity of research as to how meaning-making actually shapes transformative outcomes in short-term study abroad immersion programs (Jones et al., 2012).

An early study by Mayes (2010) asserts the tenets behind existentialism is its centrality for self-discovery and its means of allowing one to determine what is held as most important in one's life while honoring the commitment by "living in good faith" and "living true to oneself" (p.29). It is towards this thought where Kontogeorgopoulos (2017) contends that "living authentically from an existential point of view means embracing and accurately representing, rather than running away from one's true self" (p. 3). Martin Heidegger, a German philosopher who

extensively studies existential behaviors, identified three characteristics of existential authenticity in one's journey towards self-discovery: (1) knowing one's own possibilities, (2) having the tenacity to have one's own possibilities, and (3) having found one's place in this world (Steiner & Reisinger, 2005). If these tenets of existential outcomes hold merit, then students who participate in education abroad have the ability to self-discover their own possibilities through their lived experiences, self-actualize new possibilities, and find their identity through meaning-making activities, all while constructing new perspectives that move their intentions towards degree aspirations and attainment after participating in a global experience.

Several studies have examined existentialism from a philosophical framework (Barber & King, 2014; Kirillova et al., 2017; Mayes, 2010; Steiner & Reisinger, 2005). The findings express the extent to which existentialism can be examined from an educational framework to better understand how education abroad experiences hold efficiencies that promote existential authentic domains of self-discovery in students such as meaning-making, identity work, maturing, and self-authorship. Kirillova et al. (2017) further note that these types of domains of self-discovery not only promote similar existential outcomes seen in tourism's transformative experiences but often are mirrored in short-term immersive study abroad experiences.

Existential learning outcomes ingrained in these lived experiences hold authentic triggering moments shaped much like authentic triggering moments found in global education. It is through these moments where exploration of one's *self* begins and where "familiar constraints, norms, obligations, roles, and expectations

associated with everyday life are altered, suspended or reversed" and the perception towards understanding *others* begins (Kontogeorgopoulos, 2017, p. 5).

Developmentally effective experiences (DEE), as described by Barber and King (2014), are experiences that promote two types of existential authenticity: meaning-making and self-authorship, both of which can be delivered through education abroad experiences. Abes and Hernandez (2011) add that self-authorship has the ability to facilitate the new knowledge gained from experiences because "self-authorship depends on students seeing themselves as knowers" (p. 98) in order to become authentic. Baxter Magolda (2009) postulated self-authorship as simply a form of "understanding and owning one's views and decisions" (p. 434), often leading to the capacity to construct self-beliefs within oneself. The principle from this finding champions the ability for engineering students to reconstruct beliefs based on education abroad experiences.

Lilley et al. (2015) recognized these ontological perspectives as conceptualized global learning components and facilitators of change that function as manifestations of change. As part of the change, the student mindset becomes fluid and moves through its own expanded understanding of cultural perspectives in an attempt to become existentially interculturally authentic. Lilley et al. (2017) suggest that education towards global citizenship can be "conceptualized" through a more "transformative cosmopolitan lens" providing support for an ontological perspective that develops the "ideal global graduate" creating "cosmopolitan aims for educating socially responsible global citizens" (pp. 6-7).

Accordingly, this catalyst for existential change can be embedded through an intersection of cultural activities in a global engineering track that can challenge a student's perspective of self and others towards accepting differing cultural 'ways of knowing'. In the context of travel as a means for identity and self-development, global education may offer students the opportunity for personal identity formation as a formal rite of passage. Short-term study abroad was found to reframe and shift perspectives, awareness, and worldviews (Gabowski et al., 2017; Sternberg, Bonney, Gabora, & Merrifield, 2012).

In contrast to existential authenticity, a study conducted by Gutierrez and Park (2015) reported that life events associated with the transition into adulthood while in college increases existential anxiety. These life events (living away from home, working for the first time, and struggling to find personal development) are associated with the transition period during college and directly intersect within adulthood. More specifically, these events are often filled with multiple anxieties, one being existential, in which students are anxious about their career choice. It is a transition period and a time when "young people grow, mature" and "learn with an emphasis on the development of personal qualities at a transitional moment" (Snee, 2014, p. 843). This influential period of transition in a young adult's life begins their search for a way to identify themselves and find a sense of purpose towards existential authenticity. The search can often take the form of education abroad as it aids in assembling a higher sense of identity: one based on self-constructs and not the constructs of others (Snee, 2014).

Existentialism can be examined and framed from a Heideggerian perspective in that self-authenticity is more than just experience-based; it is formed by moving beyond oneself, allowing multiple domains of self-discovery, meaning-making, identity, maturing, and self-authorship to develop, very similar to outcomes found in volunteer tourism, that influence one's behavior. Existential authenticity as a value-added benefit is an activity-based philosophical approach to an understanding of self or meaning-making, specifically in activities in volunteer tourism (Kontogeorgopoulos, 2017; Rickly-Boyd, 2015; Steiner & Reisinger, 2005; Stoner et al., 2014) and seems to parallel the values derived from participation in education abroad. The combination of the phenomenology of philosophy and existentialism are woven in the form of transformative experiences, acting as catalysts for change, and as theoretical frameworks for understanding individual lived experiences (Kirillova et al., 2017; Wang, 1999).

Existential authenticity as an attribute has parallel genuineness in terms of being one's true self and making conscious choices in life based on one's lived experiences that are often non-conforming (Steiner & Reisinger, 2005). This proposal presents an intercultural spectrum that reflects identifying entry points of non-academic outcomes that could be used to determine are ways in which students reach domains of existential intercultural authenticity, what those domains might look like, as well as how engineering students who participate in education abroad can use this form of transformation to understand and balance authenticity while moving from theory to application in an engineering track or program.

An early study by Mayes (2010) asserts that the tenets behind existentialism is its centrality for self-discovery and its ability to allow one to determine what is held as most important in one's life while honoring the commitment by "living in good faith" and "living true to oneself" (p. 29) towards becoming authentic. It is through this lens that Kontogeorgopoulos (2017) contends that "living authentically from an existential point of view means embracing and accurately representing, rather than running away from one's true self" (p. 3).

Martin Heidegger identified three characteristics of existential authenticity held in one's journey towards self-discovery: (1) knowing one's own possibilities, (2) having the tenacity to have one's own possibilities, and (3) having found one's place in this world (Steiner & Reisinger, 2005). If these tenets of existential outcomes hold merit, then one could argue that students who participate in international engineering education should be able to self-discover their own possibilities through lived experiences, self-actualize new possibilities, and find a cultural identity while constructing existential authenticity from meaning-making experiences. The essence of existentialism, as it relates to both travels abroad experiences and human behavior, is ingrained in the perceived benefits of tourism experiences. Jean-Paul Sartre, a highly-regarded existential philosopher, sees the construction of meaning as an act performed by one's own self at a consciousness level. This construction is important, as there is a paucity of research specifically focusing on how meaning-making shapes transformative outcomes in short-term immersion programs (Jones et al., 2012).

Several studies have examined existentialism from a philosophical framework (Barber & King, 2014; Kirillova et al., 2017; Mayes, 2010; Steiner & Reisinger, 2005). This capstone contends that existentialism can be examined from an educational framework in order to better understand how education abroad experiences in a structured engineering program provide students the ability to promote existential domains of self-discovery in such areas as meaning-making, identity work, maturing, and self-authorship. Kirillova (2017) determined these self-discovery domains not only conform to existential outcomes, but are found in tourism transformative experiences which often mirror short-term immersive study abroad experiences.

Existential learning outcomes ingrained in these experiences also hold similar authentic triggering moments that are shaped much like the authentic triggering moments found in experiential education abroad. Through these types of experiences, student perceptions change through cultural exploration when "familiar constraints, norms, obligations, roles, and expectations associated with everyday life are altered, suspended or reversed" (Kontogeorgopoulos, 2017, p. 5).

Short-term Study Abroad. There is a consensus in the literature reviewed that short-term study abroad programs should include semester-long academic courses that culminate with an eight week or less experience abroad with no agreed upon average time spent in-country (Donnelly-Smith, 2009; Gaia & College, 2015; Kamdar & Lewis, 2015; Kerzmann, 2016; Parkinson, 2007; Walters, Charles, & Bingham, 2017). Short-term study abroad should include no less than employer,

cultural, and educational site visits while connecting engineering curriculum with real-world experiences. Parkinson (2007) adds that study abroad, despite the length, should allow students to gain a snapshot of the world through an immersive experience.

Short-term study abroad as an experiential education option in the Global Engineering Track was designed around these criteria with the intention to adding value learning outcomes beyond the traditional campus-based courses (Tarrant et al., 2014). Holistically, according to Chow (as cited in Kronholz & Osborn, 2016), study abroad is where one receives academic credit for studying in another country.

Short-term study abroad as a form of internationalization of curriculum is the most impactful platform of experiential education used to foster global citizenship (Downey et al., 2006; Tarrant et al., 2014), particularly in engineering. A study by Kato (2019) found semester-long study abroad was an effect of participation in short-term study abroad. Findings from their study showed that 19.1% of participants in a semester-long study abroad had participated in a short-term study abroad program. A 2018 survey of U.S. study abroad by the Institute of International Education (IEE) shows a record number of college students are choosing to study abroad (Mills et al., 2010). While engineering is experiencing an annual decline in the number of students entering the field, it is concerning that engineering is not following that trend and notes that only 2.9% of engineering students participate in study abroad programs, well short of the 10% national average (Johnson & Jones, 2006).

According to Albers-Miller, Prenshaw, and Straughan (1999), one reason for the lack of engineering participation in a study abroad program is that students are misinformed about opportunities, are not aware of the opportunity, and hold inaccurate assumptions about the financial implications and time constraints of going abroad. Despite these reasons, study abroad, in particular short-term, is an appealing opportunity to both institutions and students for a variety of reasons, which include cost, time, and ease of supporting an abroad experience into an engineering curriculum (Kato & Suzuki, 2019; Mills et al., 2010).

As early as 2007, short-term study abroad experiences were expanding and accounted for more than half of the studying abroad experiences (Yu, 2012). At one mid-sized university, 3.49% of their students perform semester-long study abroad annually; however, only .01% of participants were enrolled in an engineering program. Still, short-term study abroad is an attractive option for engineering students as it is more affordable than a semester abroad, is easily structured into the curriculum, and provides a safe initial exposure to a different culture (Donnelly-Smith, 2009; Gaia & College, 2015; Mills et al., 2010). One additional intrinsic benefit of a short-term program is that it aspires students towards future semester-long study abroad and engagement in future activities with global communities (Kamdar & Lewis, 2015; Kato & Suzuki, 2019; Tarrant et al., 2014).

Norris and Gillespie (2009) found there is a growing call from policymakers, researchers, and employers asking, “higher education to support and refine existing education abroad” (p. 383) programs to this end. The authors further contend that

institutions should adopt a normative approach to facilitating international experiences by designing "new opportunities that transport participants well beyond the role of tourist, educational consumer, or isolated and unengaged American abroad" (p. 383). As the classroom is becoming centered on real-world experiences and towards the internationalization of curriculum, higher education should take advantage of the cultural learning outcomes that are held in short-term study abroad.

Short-term study abroad experiences, when combined with academics and performance, seem to promote global competencies that are desired by organizations, recruiters and companies (Kronholz & Osborn, 2016). Studying abroad provides students an opportunity to develop a global mindset and the ability to collaborate with others from differing countries while being able to adjust to global ambiguities (Commander et al., 2015; Kamdar & Lewis, 2015).

One vein in the Global Engineering Track cultural intersection is experiential education. This vein provides an opportunity for students to participate in both short-term and semester-long study abroad. As a form of micro-immersion into a different culture over a short period of time, short-term study abroad is an approach to learning other than classroom instruction that is viewed favorably by students (Albers-Miller, Prenshaw, & Straughan, 1999). Study abroad, according to Clifford and Montgomery (2015), is centered on the contention that students would rather "live the course" than endure it, giving permission towards curriculum reform and the introduction of study abroad options into engineering programs. Accordingly, experiential education as a cultural intersection in a global track is one model of providing global education

without extending a student's time to degree or having students shoulder the cost of a study abroad semester.

Study Abroad Data. When developing a short-term study abroad program, this researcher posits that an institution should consider institutional knowledge in the form of mega-trends in study abroad, global student experience surveys, and Open Doors reports to tailor their program to a specific audience. As an example, Walters et al. (2017) found that study abroad students are historically female and Caucasian. Specifically, 59% of all students performing a study abroad enrolled in a short-term program of 8 weeks or less (Gaia & College, 2015; Kamdar & Lewis, 2015; Tarrant et al., 2014). An Open Doors 2018 report indicates in Table 2 how short-term study abroad up to eight weeks can be seen as a mega-trend with consistent growth since 2010/2011.

Table 2

Profile of U.S. study abroad students 2010-2016

	U.S. STUDY ABROAD STUDENTS (%)					
Duration of Study	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**
Summer Term	37.7	37.1	37.8	38.1	39.0	38.0
Summer: More than eight weeks	-	-	-	-	*2.7*	*2.6*
Summer: Two to eight weeks	*34.4*	33.4	*33.7*	*33.5*	*30.9*	*30.4*
Summer: Fewer than two weeks	*3.3*	3.7	*4.1*	*4.6*	*5.4*	*5.0*
One Semester	34.5	35.0	33.6	31.9	31.8	31.9
8 Weeks or Less During Academic Year	13.3	14.4	15.3	16.5	16.7	17.4
Two to eight weeks	*5.0*	*6.5*	*6.9*	*6.6*	*6.5*	*6.6*

Fewer than two weeks	*8.3*	*7.9*	*8.4*	*9.9*	*10.2*	*10.8*

Increased participation in short-term study abroad is a positive trend. With expanding forms of internationalization of curriculum, there is little debate among higher education of the benefits derived from participation in study abroad programs (Bettez, 2004). The 2005 Lincoln Commission set a goal of having one million U.S. students studying abroad annually by the end of 2016/2017. The interest in high school seniors towards study abroad was strong going into 2009 where 60% of students were interested in international education (Norris & Gillespie, 2009) However, in 2016/2017, only 332,727 students across all fields actually studied abroad according to a report from an Open Doors Data on U.S. Study Abroad Students.

Study Abroad Learning Outcomes. Sobania and Braskamp (as cited in Mills et al. (2010) best describe learning outcomes from study abroad as a way for students to "identify similarities and differences in cultural values; to recognize ethnocentric reactions that inhibit the cultivation of cross-cultural understanding, and to challenges one's own stereotypes and myths about people" (p. 25). According to Park (2015), study abroad outcomes provide developmental impact and construct meaning-making in activities, allowing a subjective sense of purpose in students that is derived from the experience. These mean-making experiences, which are activities in identity work such as study abroad, develop self-authorship, the understanding of one's own self, in students. Seen in outcomes from volunteer tourism, they hold similar associations in

existential activities (Barber & King, 2014; Kirillova et al., 2017; Steiner & Reisinger, 2005).

According to Clifford and Montgomery (2015), this transformational pedagogy requires student interaction inactivity's such as study abroad that can entrench a student's interest in developing a culture of self-authorship. The authors further contend that these experiences lead to what Mezirow sees as an "understanding of the self, an awareness of the self in relation to others, and in turn… changes in how one sees the world" (p. 48). This shift in perspective is important as these types of epistemological outcomes framed inside global engineering programs can be formed by providing study abroad opportunities.

In a study abroad alumni survey by Norris and Gillespie (2009), the findings suggest that study abroad influences a participant's career towards an international dimension. Further, the outcomes from the international experience increased self-awareness, foreign language, social development, and intercultural competence. Outcomes from study abroad also include cross-cultural understanding, global mindedness, a sense of self-efficacy, and a broadening of one's perspective towards internationalization (Bettez, 2004; Kato & Suzuki, 2019). From an institutional lens, study abroad fosters an increase in graduation rates, academic development, disciplinary learning, and a student population of ambassadors of international and cultural advocacy (Gaia & College, 2015). According to Preston (2012), 84% of study abroad alumni reported in the Institute for the International Education of

Students survey that education abroad provided them with the job skills needed to be successful in the workforce.

Study abroad also produces types of capital that can include financial, human, social and cultural. Short-term study abroad increases international awareness, intercultural awareness, emotional intelligence, self-awareness, social consciousness, and community activism (Kato & Suzuki, 2019; Walters et al., 2017). Students who participate in study abroad have seen an increase in their career decision-making abilities, gained self-confidence and self-knowledge towards career goals, and discovered their vocational identity (Kronholz & Osborn, 2016; Mills et al., 2010). These outcomes are produced within the global track's cultural intersections as it moves student's perspectives from an ethnocentric state to ethno-relativism, in which, according to Bettez (2004) and Bennett (2011), students gain a sense of global mindedness and an enhanced sense of self-efficacy.

Why Engineering Needs Study Abroad. Tarrant (as cited in Mills, Deviney, & Ball, 2010) claims that "the future workforce of America depends on a citizenry that is sensitive to, and aware of, global issues" (p. 433). Moreover, Tarrant et al., (2014) argue that higher education is being called upon by employers, policymakers, researchers, and practitioners to facilitate stronger education abroad programs and experiences that promote global-ready engineering students. Engineering programs should look to design global experiences that "transport participants well beyond the role of tourist, educational consumer, or isolated and unengaged American abroad" (Norris & Gillespie, 2009, p. 383). By doing so, students will be prepared to function

in a multi-cultural environment and be able to market their study abroad experiences to employers as globally marketable job skills (Mills, Deviney, & Ball, 2010; Stroud, 2010).

Engineering students in a mandatory cooperative education program are looking for global education options as they realize the potential benefits, both professional and personal. They are leaning on institutions to provide global affordances that will develop the skills needed in engineering in order to work in a diverse labor force that is continuing to evolve (Mills et al., 2010). Given this increasing demand for institutions to prepare students for a global working environment, institutions are slowly beginning to recognize the value of global education in engineering. According to a 2008 Open Doors Report (as cited in Stroud, 2010), there is a "growing recognition by students and educators that an international experience is important to students' future careers" (p. 503). As a benefit, Stroud (2010) contends that institutions that invest in global education opportunities are perceived as more likely to offer an environment of engaged learning that even attracts students, which can apply in an engineering program.

Kronholz and Osborn (2016) found study abroad experiences, when combined with academics and in-country performance, are traits desired by organizations, recruiters and companies. Given the need to develop global competencies to meet employer work-ready needs and the student demand for global experiences, Ramirez (2013) suggests that approaches in the curriculum should be filled with endless global possibilities despite known challenges. In response to a call from employers for

higher education to produce students with global competencies, a short-term study abroad program was framed into the Global Engineering Track as experiential education for students. Studying abroad provides students an opportunity to develop the global mindset employers are demanding along with the benefits of individual and personal growth (Kamdar & Lewis, 2015).

Ramírez (2013) contends that education abroad has the strongest potential to shape the next generation of global engineering students using collaborative and communication skills aimed at bridging global differences and boundaries. Since education abroad has the highest impact on a student's cultural perspective and presuppositions, the Global Engineering Track integrated short-term study abroad into its experiential education intersection as an immersive requirement. Breunig (2005) contends that the value of experiential education is in providing purposeful experiences. In reviewing Breunig's research of experiential education and critical pedagogy towards praxis, it was evident that a global track experience should hold intention, purpose, and direction using study abroad. Accordingly, the global engineering track provided an attractive pathway for engineering students to gain intercultural knowledge. It offers global experiences in a short-term or semester abroad and can be easily structured into the curriculum, providing a safe initial exposure to another culture (Donnelly-Smith, 2009; Gaia & College, 2015; Mills et al., 2010).

Best Practices in Developing Study Abroad in Engineering. The most important best practice found in developing study abroad programs is to ensure that

the design appeals to students and that it accommodates their needs (Albers-Miller et al., 1999). One approach used in making sure study abroad programs do not stretch students beyond their ability is to involve them in developing and planning the study abroad (Mills et al., 2010). By employing these student-centered internationalized approaches, institutions and students can identify specific study abroad goals and objectives in which parallels between the learning and actual activities result in a deeper understanding of diverse cultures (Commander et al., 2015; Gaia & College, 2015).

Developing study abroad programs in engineering requires curricula that can not only work around cooperative education but can promote a focus on human diversity with an intensive focus towards developing cultural competencies (Walters et al., 2017). Best practices should focus on faculty-led courses that require extensive in-class preparation, link in-country experiences with course content, and include on-site reflection using journaling to compliment group reflection (Gaia & College, 2015). This best practice was seen in the Global Engineering Track's short-term study abroad program in which students get exposed to cultural differences using case studies, research, and lectures combined with in-country experiences centered on culture, country, travel, and globalization. These prerequisites for a study abroad experience allowed students to connect academics with study abroad activities.

Institutions should provide students with a suite of integrated global programs such as study abroad and global engineering tracks (Parkinson, 2007). These global programs should connect learning directly with the experience abroad using cultural

activities, academic in-country lectures, and in-class team-building exercises. Walters et al (2017) found that in order for transformative learning to maximize student experiences, study abroad programs should be centered on influencers such as prior student experiences, destination, service-learning opportunities, the novelty of the experience, and journal writing. Furthermore, students should be exposed to four concentrated areas of learning during study abroad experiences: cultural, country, travel, and globalization (Donnelly-Smith, 2009; Kamdar & Lewis, 2015; Olson & Lalley, 2012). These four stages provide students with a broad stroke of outcomes that include ethno-relativism, survival language, social justice, and ways of knowing how to solve complex engineering problems (Olson & Lalley, 2012). Tarrant et al., (2014) believe these focal points are where transformation begins, as they expose students to new places, diverse cultures and learning environments that challenge a student's current beliefs, perceptions, and understanding of self.

Programs found to hold positive outcomes relied on assessments from faculty who tied learning objectives and syllabus with academics (Mills et al., 2010). Donnelly-Smith (2009) adds that the experience and activities must be integrated into the local community. According to Olson and Lalley (2012), short-term faculty-led programs should include four to five business visits in-country and end with daily debriefings after the experience. Group and individual reflection, journaling, end of trip reflection, and end of day debriefing after site visits develop the student's global mindset and enlist intercultural sensitivity (Donnelly-Smith, 2009; Kamdar & Lewis, 2015; Mills et al., 2010; Olson & Lalley, 2012).

The success of these highly structured activities should be centered around critical reflection in which every activity in-country is tied directly back to what students learned in the classroom (Donnelly-Smith 2009). Sarah Spencer, director of short-term programs at the University of St. Thomas, agrees that "institutions must have strong academic foundations for their short-term programs" and that good short-term study abroad programs should be "strongly connected to coursework and an integral part of a larger learning experience" (as cited in Donnelly-Smith, 2009, p12). In developing curriculum for experiences abroad, Norris and Gillespie (2009) insist that institutions should ensure there is a balance between structured academic activities and unstructured time, and that it is easier for students in the activities to conform to the host country's cultural norms.

Engineering abroad programs should look to design international experiences that will provide students with the contextual and practical knowledge to be able to assimilate into an ambiguous environment; they should encourage engineering students to engage and explore the global context of the discipline; and, equally, they should promote continuous learning about the culture, politics and host economy once they return from a study abroad (Kamdar & Lewis, 2015). According to Stroud (2010), one way in which institutions can address this type of program design is to understand the characteristics and backgrounds of the students, in particular, their intent to study abroad. Kamdar and Lewis (2015) add that programs should also develop the ability to apply theoretical knowledge as well as promote an appreciation for differences in cultural practices.

Global engineering programs provide students with an opportunity to participate in international experiences with most short-term formats offering the benefit at a reduced cost over semester-long study abroad. However, as institutions begin internationalizing their curriculum to include Compact International Experiences as education abroad, Schubert, Diego, Angeles, and Jacobitz (2011) maintain that the program's technical content and international experience must be assessed. For instance, at the University of San Diego (USD), the international engineering education is assessed on a four-prong approach: (1) student-evaluations, (2) instructor evaluations and course grades, (3) student reflection papers, and (4) student experience surveys. Findings from their assessment of engineering international experiences point to a level and depth of a typical semester at the home institution but with an added benefit of a meaning-making experience.

Challenges to Study Abroad in Engineering. There are challenges in offering study abroad in an engineering curriculum. Courses in engineering are often offered only within certain semesters based on a set teaching plan, which complicates a student’s accessibility to international experiences. An engineering school with mandatory co-op leaves little to no room to expand students’ global offerings beyond local borders or embrace internationalization in the curriculum. Increased participation in study abroad, both semester and short-term, in engineering is seeing an increase, keeping pace with a growing internationalization of curriculum. In an Open Doors 2018 report, 5.3% of all engineering students performed study abroad, up from 3.1% in 2006. Yet, according to Stroud (2010), despite this growth, barriers of

concern include “credit transfer … lack of faculty/campus support … lack of foreign language knowledge” (p. 495), and in the capstone, a stringent curricular design that still presents the greatest challenges to studying abroad. Along with limited financial resources, the ability to provide global programs that do not extend the time to degree in engineering is difficult. Due to a strict sequence of course work, a student’s ability to participate in study abroad is complicated (Commander et al., 2015; Parkinson, 2007; Stroud, 2010). Lastly, Ramirez (2013) urges institutions to identify and address challenges in study abroad and see it as career development and a career decision tool.

Transformative Learning Theories Applicable to International Education: Strands of Learning Theories.

Transformative learning represents theoretical frameworks for understanding how adults learn. It is the process of using interpretations of meaning-making experiences to construe new or revised interpretations and to challenge assumptions to foster self-actualization (Dirkx, 1998; Grainger et al., 2015; Taylor, 1998). Perspectives, identified and constructed through meaning-making experiences, are the foundation on which assumptions and beliefs are hinged and offer the most conscious level of learning (Dirkx, 1998). Learning is a complicated process in which instructional settings, learning approaches, and adjusted perspectives are used to foster change in the learner. Mezirow (as cited in Taylor, 1998., p. 11) sees the outcome of transformative learning through a developmental lens. He argues that once we gain clarification and commitment to the changes in our perspectives, our levels of change never regress and we hold a more inclusive and

discriminating view of the world in regards to culture. Changes in perspectives are reflexive and critical in the development of intercultural authenticity in the global track.

Dirkx (1998) presents an overview of theoretical strands of transformative learning in the works of Paulo Freire, Jack Mezirow, and Larry Daloz. These three strands of thought represent a conceptual framework that influences how transformational learning applies to programs in international education. At its core, these strands allow students to understand the meaning in their experiences, confront existing presuppositions, and question how their values and beliefs exist in the context of others on a global scale. The strands are briefly reviewed in order to establish how transformative learning views are important educational theories and how each approach can be applied to the internationalization of higher education and the global engineering track.

Paulo Freire views transformative learning as a process of gaining the ability to develop a deeper understanding of how one sees themselves and the world. This critical consciousness consists of a process of action and reflection as seen in the track's experiential education and critical reflection (Dirkx, 1998). Jack Mezirow views transformative learning as the very essence of gaining understanding using critical reflection from making meaning from one's experiences. Dirkx (1998) points out that Mezirow sees critical reflection as a process in perspective transformation in that it serves as a lens to understand one's self and others in the world. This type of perspective shift in transformative learning can be seen in the contexts of co-

curricular activities in informal adult learning settings such as lectures, classes, and social settings which are included in the stages of the global track.

Taylor (1998) suggests that the learner's centrality of experiences and the ability to negotiate values, purpose, and beliefs is the starting point in transformative learning. According to Mezirow's theory, most learners hold casual and paradigmatic assumptions about the world around them and in order to change those assumptions, a disorienting dilemma is needed to trigger changes in one's attitudes and beliefs (Christie, M.; Carey, M.; Robertson, A.; Grainger, 2015). In the context of internationalization of programs, the dilemma may be a study abroad, either long or short-term, through which the learner is often displaced and their prescriptive assumptions are challenged.

Larry Daloz views transformative learning as a development process through which one aims to find meaning in formal learning such as curricular activities in the global track. This concept clarifies how students can replace current ways of making meaning of experiences and construct new meanings that are more appropriate based on the experience (Dirkx, 1998). Dirkx asserts that it is a form of letting go of one's sense of self and moving forward to the construction of "new ways of seeing the self and the world" (p. 6). Accordingly, global programs in engineering should seek to foster transformative learning within meaning-making experiences and look to understand how cultural intersections can play a role in the understanding and development of "self" in a learner. Dirkx (1998) best summarizes the potential of transformative learning by regarding learning as not having a distinct beginning nor

an ending but rather as focusing on the “being” rather than “becoming” in the change process from meaning-making experiences.

Congruent experiences and challenges to cultural assumptions foster transformation and are woven into stages in the global track. If the track provides an opportunity for students to critically assess and change their assumptions from meaning-making experiences, Grainger et al. (2015) contend that students will gain the ability to adopt new cultural behaviors. By doing so, students can transition into authentic global citizens and understand how their experiences in a global context can lead to intercultural competence. Transformation takes place when the pursuit of learning involves reflection and shapes our meaning schemes directly from the experience.

Meaning structures, according to Taylor (1998), are evolutionary and when they involve tasks that focus on reflection, they move learners into a stage where they judge their presuppositions. This stage begins their transformational learning. It is under this premise that the meaning-making of experiences, based on cultural assumptions and presuppositions, can revise an engineering student’s perspectives and can act as a reference to shape particular cultural behaviors and views (Dirkx, 1998; Taylor, 1998).

Accordingly, transformation then becomes about understanding how international education ensures that meaning-making experiences (the perspective changers) become embedded in the curriculum and are not simply a supplemental component. Such meaning schemes are known as components of knowledge that help

students shape specific beliefs, values, and cultural views based on their experiences. Theories of development should be integrated into the curriculum, co-curriculum, experiential education, and critical reflection with an underlying focus on promoting global capacities and culture. Taylor (1998) provides a complimenting overview of Dirkx's (1998) transformative learning discussion by relating which conditions need to be present to foster change in perspectives. Mezirow's perspective transformation provides the reason behind a shift in cultural views as his theory concentrates on individual transformation (Grainger et al., 2015).

Mezirow's Perspective Transformation in Meaning Structures

Meaning Schemes	Meaning Perspectives
Shapes articular behaviors and views	Shapes references, world-view and paradigm

Students hold an ingrained cultural view defined by a number of congruent experiences that have shaped their perspectives of themselves and others. These meaning perspectives act as barriers that can often constrain change and reduce their view of the world to a subjective and distorted reality (Taylor, 1998). It is important to understand the implications of this view and how it applies to students in engineering as one goal is to change a student's cultural perspective and shift their world-view as well as their personal view towards becoming culturally authentic. It is equally important to note that multiple models or stands of educational theories contribute to the validation of transformative learning and that transformation is an ongoing and never-ending process.

Taylor (1998) points out when students approach a new experience their "meaning perspectives act as a sieve through which each new experience is interpreted and given meaning" (p. 7). Higher education should ensure their internationalization efforts challenge one's assumptions and presuppositions based on Mezirow's theory of perspective transformation. A global context to Mezirow's (1991) theory of perspective transformation should be added if a learner's frame of reference becomes culturally "inclusive, differentiating, permeable, critically reflected upon, and integrative of experience" (as cited in Taylor, 1998, p. 7) while embedded in the curriculum, co-curriculum, experiential education and critical reflection activities or experiences.

Transformative Perspective Changes from Self to Others. In order for students to truly understand cultural differences, they must shift their perspectives of self and others. This call for transformation leads to the development of what Mezirow (1991) sees as an "understanding of the self, an awareness of the self in relation to others, and in turn…changes in how one sees the world" (p. 48). Clifford and Montgomery (2015) suggest that a new theory of transformational pedagogy is needed involving student interaction, experiences, and activities that entrench student's interest in developing a culture of self-learning. Using student development theories that build on Mezirow's perspective transformation will influence the practice of engineering on a global scale. Such thoroughly transformation-based theories should demonstrate how the perspective transformation allows a student to

participate in a meaning-making experience in study abroad and walk away with changed beliefs, values, and assumptions that are shaped by life events (Dirkx, 1998).

Epistemological outcomes can be demonstrated through a structurally designed global engineering track in which student perspectives and understanding shift from one's self to others. Figure 1 presents how overarching developmental stages of learning along a Spectrum of Intercultural Development (SID) allows students to participate within a spectrum of cultural intersections where curricular, co-curricular, experiential education and critical reflection activities can promote transformational changes.

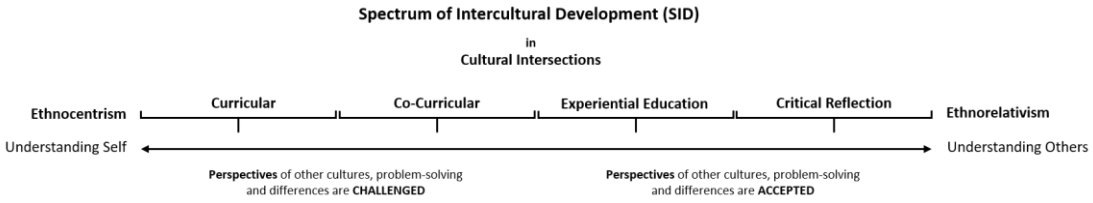

Figure 1. A Spectrum of Intercultural Development

Accordingly, this type of transformation process becomes important when developing new global engineering programs as a form of internationalization of curriculum. The SID offers engineering schools a map of outcomes that can produce deep-rooted change by fusing authentic lived moments in experiential education with developmental domains. This process enhances personal qualities, problem-solving and communication skills, and self-interest as evident in outcomes of students who travel for volunteer tourism (Blackburn et al., 2005). There are value-added benefits and transformational change that can be gained from SID's experiential education

(Stoner et al., 2014; Tarrant, Rubin, & Stoner, 2014; Tyran, 2017). For instance, the social cognitive theory of learning asserts that students can learn by observing others; when put in the context of participating in education abroad, it promotes the probability that perhaps students can acquire cultural knowledge from observing differing beliefs and culturally-appropriate behaviors.

Student development exists in the outcomes of participating in the global track. When aligned with intentional internationalized learning objectives, transitions a student's understanding of 'self' to that of understanding 'others', altering one's perspective through direct participation in multiple dimensions of development (Davis et al., 2018). Participation in the SID not only actualizes intercultural knowledge but fosters values in personal development and cultural dispositions towards intercultural understanding ("Intercultural Understanding" n.d.). According to Lilley, Barker, and Harris (2017), the process addresses how a global engineering track can take a transformative approach towards reaching intercultural authenticity in a spectrum of structured affordances to develop global engineering students and produce an "ideal global graduate" (p. 7).

When was this capstone implemented?

The aim of the confluence between a global engineering track and global experiences is to alleviate the constraint and travel barriers in an engineering curriculum. Students who participate in the global track will truly be able to compete in today's economic market as engineers and will have international opportunities that can provide them with cross-cultural experiences. By allowing students to

substitute an international option for their co-op rotation(s), the engineering school is creating a change in the method of engineering education and within a co-op culture. The capstone was implemented in 2017 to develop a Global Engineering Track as a programmatic model to develop students and internationalize curriculum.

The Global Engineering Track internationalizes the engineering curriculum in two ways: first, by targeting a population that at the time of this research has limited to no global programming opportunities, and second, by providing global affordances such as short-term study abroad and international service learning in a semester culture course culminated by an in-country experience abroad.

The Global Engineering Track is a model for developing intercultural competence in engineering students as it overcomes the obstacle of mandatory cooperative education. The program provides for international mobility of engineering students and addresses a problem in academia where internationalization of curriculum is under-valued and under-represented (Blumenthal & Grothus, 2008). Lim and Bloomquist (2015) condense the track definition and simply state that the global engineering track provides a "type of experiential learning that balances service with learning, and includes well-structured critical reflection" (p. 198).

Programming Curriculum Efforts. Grudzinski-Hall et al. (2007) present one model towards the internationalization of the engineering curriculum at Lehigh University in a Global Citizenship Program. The focus of their program is to provide engineering students structure and focus on using curricular, co-curricular and international experiences to develop global perspectives. The Lehigh program was

designed with a stringent engineering curriculum in mind as a way to internationalize their curriculum. Similar in focus, the Global Engineering Track extends the design at Lehigh to include experiential education and critical reflection adding two culturally engaging stages within the program.

A second comparable model to the Global Engineering Tracks' ability to integrate global competence into an engineering curriculum is the International Plan at Georgia Tech. Lohmann et al. (2005) found that their program requires students to participate across three stages of activities and experiences they deemed as essential to gain global competence: “coursework in international studies, language proficiency, and immersive international experience” (p. 123). The Global Engineering Track requires its students to participate across four stages that include coursework in diversity studies, service learning, an immersive international experience, and critical thinking but without a language component.

Institutions incorporating the global track model can easily modify the elements within the stages to accommodate their academic requirements. In terms of program design towards developing global competence in engineering students, the elements in the International Plan seem to complement elements in the Global Engineering Track: proficiency in a second language, international coursework, immersive international experience, a structured program that binds these elements, and a program that integrates the experience into the field of engineering (Lohmann et al., 2005).

Study Abroad and International Service Learning. Short-term study abroad and international service-learning as experiential education were added as a pedagogical practice as this type of learning has been in higher education since the early 1990s (Lim & Bloomquist, 2015). According to Tyran (2017), international learning is seen as a partnership with an international community that involves expanding the boundaries of learning towards the "experience of collaboration, service, reflection, and critical thinking" (p. 163). Long-term student benefits and benefits to those served are the focus of any service-based experiential education program. Tyran (2017) supports the notion of international service-learning as a pedagogical approach noting that transformational learning and an action plan by the students as a final plan (critical reflection) is needed in order to conceptualize how curriculum can move from theory to practitioner-based outcomes.

Accordingly, the Global Engineering Track added a partnership with the Andean Alliance for Sustainable Development (AASD), a community-based non-governmental program in Calca, Peru, in order to provide engineering students with an opportunity to perform a community-based international service-learning activity. The program places students short-term in an environment where they are exposed to community collaboration and field engineering projects that benefit the communities. Students are guided through multiple transformational learning activities and perform critical reflection at every level of the global track. Clifford & Montgomery (2015) posit that the use of critical reflection is the pathway to transformative learning. To ensure the transformation is taking place, David Kolb's model of experiential learning

and John Dewey's theory of reflective thought are incorporated in the program model.

In comparison, study abroad, as a semester-long academic experience, facilitates intercultural authenticity in engineering students by creating increased self-awareness, interconnectedness and intercultural competence (Kishino & Takahashi, 2019). A reported 332,727 students studied abroad in the academic year 2016-2017 according to the 2018 Open Door Report (Norris & Gillespie, 2009). Blumenthal and Grothus (2008) contend that short-term study abroad stimulates interest in longer-term international education and promotes career-decision making towards global careers. The authors believe that global competencies should be infused in programs such as short-term study abroad to better prepare U.S. students to compete in a global market. Blumenthal and Grothus (2008) further contend that the U.S. perspective on overcoming barriers towards developing global competencies in our engineering students is one of urgency. The focus has turned over the last decade on strengthening our student's intercultural competency levels in comparison to those of engineering students around the world.

Impact of the capstone

The GET Abroad program will expose engineering students to global competencies that are both highly desirable and essential in today's engineering field. Parkinson (2009, p. 10) presents ten learning foundations for program and curriculum integration. The track will lean on five as these dimensions parallel with *ABET* accreditation competencies:

- How to understand and avoid ethnocentrism. Students will have an appreciation for other cultures.
- How to communicate not only in cultural differences but in language skills at the conversation and technical level. Students will be able to communicate across cultures.
- How to work within a diverse team of ethnic, cultural and national origin. Students will be proficient in working or directing a team of ethnic and cultural diversity.
- How to understand uncommon cultural business conduct that crosses ethical and often legal boundaries. Students will be able to effectively deal with ethical issues arising from cultural or national differences.
- How to practice, outside of theory, engineering skills through internships or experiences. Students will have had a chance to practice engineering in a global context.

These competencies will be ingrained in the GET Abroad program developing potential student outcomes through the following means:

- Attend lectures related to specific global engineering topics (UL, community, etc.)
- Complete self-paced Global Engineering learning modules related to International IQ, Pre-Departure Training, and Cultural Awareness
- Complete a summer intensive language study abroad experience
- Complete a summer study abroad experience or summer STEM course abroad

- Complete a global engineer internship during student's 4th year
- Author specific global engineering mentored research project
- Present or attend at a national or regional global engineering conference

The Global Engineering Track program will:

- Increase student's exposure to dimensions of global engineering including culture, collaboration, communication, ethics and professional practice to be stronger global citizens.
- Develop student's understanding and avoidance of ethnocentrism by developing an awareness of potential issues, sensitivity to other cultures, and an appreciation of different capacity levels.
- Expand student's knowledge of global engineering as it pertains to economics, technologies, and single markets in the world.
- Promote student's comparative understanding of global engineering practices and the role it plays in international business.

Downey et al. (2006) propose an instruction learning criterion for the development of global competency in engineering students. The authors assert that instruction or activities should hold three learning outcomes: "knowledge, ability, and predisposition" (p. 7). These outcomes were designed to guide instructional formats that prepare students with the ability to collaborate with those who define engineering problems differently.

- Knowledge: Focuses on the technical and professional understanding, boundaries and differences of engineers and non-engineers from different countries.
- Ability: Ability to process intellectual and behavioral capacities towards integrating new knowledge into everyday engineering problem-solving.
- Predisposition: Prepares students to engage, interpret and address both global and cultural differences.

The Global Engineering Track leans on these learning outcome practices as its four stages offer activities and experiences that prepare students to define technical problems in a global context and articulate outcomes that promote global competence.

There are many levels of culturally-centered outcomes gained by participating in education abroad activities, global programs and the internationalization of curriculum. To determine what types of outcomes students receive, it is important to review and define desired outcomes, the defining characteristics gained, and what role each outcome plays in building cultural capital. Bennett (2017a) asserts educators must first determine where students are at and where students should be in their understanding of cultural differences. Based on this assertion, this capstone reviewed anticipated outcomes students may gain from participating in the Global Engineering Track. Those outcomes include characteristics of global competence, intercultural competence, global citizenship, and intercultural sensitivity that lead toward the development of intercultural authenticity.

These culturally-centered outcomes embody complex yet closely related definitions. Amid the research found on outcomes gained from participating in global experiences and activities, this capstone determined that students who gain the ability to communicate and work across cultures, hold cultural empathy and ethical principles, and have had an opportunity to practice engineering in an international setting gain intercultural authenticity (Downey et al., 2006; Lohmann, Rollins, Jr., & Hoey, 2006; Parkinson, 2007). Accordingly, developing global programs that foster outcomes that lead to the understanding of different cultures becomes even more important.

Ventura (2012) posits that engineering students assume everyone shares and holds similar cultural beliefs particularly in those students who have not been exposed to new different cultures. Bennett (2017) adds that the assumption applies to their experiences, values, and beliefs, and are not bound by cultures, but apply to everyone. Outcomes that require students to adjust their perspectives, promote diverse communication, create cultural awareness, or even engage in real-world experiences lead to what this researcher deems as intercultural authenticity.

Global Competence as a Learning Outcome. A number of studies that defined global competencies found that engineering students must have the ability to work and live effectively within different cultures; be able to work alongside others who define problems differently than they do; and, know-how to solve complex global problems (Downey et al., 2006; Lohmann et al., 2006; Mihelcic et al., 2008; Olson & Lalley, 2012; Parkinson, 2007). The research pointed to the challenges

engineering students face in gaining global competencies and offered initiatives as to how global engineering should be translated into the curriculum. Lohmann et al. (2006) urge institutions to look at trends to prepare engineering students to the gain global competence needed to succeed in a multifaceted engineering new environment.

These trends are what this researcher terms as "institutional knowledge." Institutional knowledge provides an array of answers to questions such as how other institutions are preparing students with skills and abilities, the type of competencies that are emerging due to the impact of globalization, and the extent to which worldwide challenges such as sustainability, safety, and social justice play a role in new engineering competencies (Lohmann et al., 2006). There are three new skills according to the authors that will be required of future engineers: a new multidisciplinary base of knowledge, a refined and diverse set of interpersonal skills that include global collaboration, and finally, the ability to work and live in a diverse environment.

Lafave, Kang, Kaiser, and Asce (2015) present a case study on how incorporating cross-cultural modules with critical reflection in engineering courses cultivates global competence. The modules include (1) understanding cultural differences, (2) understanding cross-cultural differences, and (3) understanding cross-cultural communication in engineering (Table 1, p. 5). Paired with post-module critical reflection, their role is to make cultivating global "competencies in undergraduate engineering students possible, at least in the context of a civil engineering integrated design course" (p. 8). This is an important case study in that its

findings validate the efforts of the Global Engineering Track's own civil engineering international service-learning course and critical reflection as stages of cultural development towards global competence.

There is no consensus on how to best develop global competence in students. According to Adelman (as cited in Lohmann et al. 2006), developing global competence in engineering students requires participation in a coherent international program or experience. Additionally, international experiences must be relevant and integrated into the student's curriculum plan in the field of engineering. The Global Engineering Track offers experiential education, an immersive experience abroad that is focused on engineering principles and curriculum. Lohmann et al. (2006) describe in Table 3 the categories used by universities to internationalize their curriculum and develop global competencies. The table represents the various forms of curriculum, cooperative education, or study abroad used by institutions to develop global competencies.

Table 3
Comparing forms of developing global competencies

Category	Form of Development	Notable institution(s)
Global track	substitute co-op for study abroad	Louisville, Cincinnati
Core / dual major	additional year of studies	Rhode Island, Penn State
Minors or certificate	second language	Illinois and Michigan
Global projects	global capstone	Worcester Polytechnic, Purdue
Study abroad	additional year of studies abroad	Minnesota, Penn State

Blumenthal and Grothus (2008) argue for a sense of urgency in US higher education to recognize and strengthen the global competencies of engineering

students. A change in curriculum is needed in higher education towards stimulating global careers while providing students with the skills necessary to be competitive in a global marketplace.

Intercultural (Cultural) Competence as a Learning Outcome. The importance of developing intercultural competence in a domestic and global context has been recognized and conceptualized in a number of studies (Cecil, 2017; Deardorff et al., 2012; Demetry, 2007; Hammer, Bennett, & Wiseman, 2003; Huang, 2017; Lafave et al., 2015). Much like the differences in defining global competence, Yu (2012) contends that "how to define intercultural competence is always a point of contention among intercultural scholars" (p. 6). It is Hammer et al. (2003) and Demetry (2007) who agree with Deardorff et al. (2012) that intercultural competence represents the ability to think, work, communicate, and behave appropriately with people from different cultural backgrounds. Deardorff further clarifies the terminology between using intercultural and cultural competence, insisting that it is the term *global competence* in engineering that is used more widely.

However, Yu (2012) draws upon other frameworks to eliminate this confusion and suggests that *intercultural competence, as opposed to global competence*, should be used, as it is built upon interrelated frameworks of sensitivity, awareness, and skills. Yu argues that cultural sensitivity and awareness are the pillars of intercultural competence. This researcher found that in other global engineering programs and research articles, the term intercultural competence was more widely accepted.

Accordingly, for the purpose of this capstone, the term and definition of intercultural competence will be used.

The cultural intersections in the Global Engineering Track adhere to Yu's concept and similarly draws upon the role of understanding one's own culture and that of others to develop intercultural competence. As an example, Huang's (2017) program development model for gaining intercultural competence suggests that a shift in a student's attitude and behavior towards cultural understanding can be gained through curriculum and co-curriculum activities. The Global Engineering Track includes these two stages of activities and adds experiential education and critical reflection. These educational spaces help bridge cultural gaps, and equally allow students to learn how to display appropriate cultural behaviors.

Huang's (2017) tripartite model reflects to posit that designing intercultural competence in activity-based programs should consider three dimensions: knowledge, action, and reflection. The programs, according to Huang, should extend beyond the scope of the traditional classroom and form a pattern for intercultural education that includes both "mandatory and optional curricula" (p. 187). Figure 2 shows how Huang's model parallels the global track in the development of intercultural competencies.

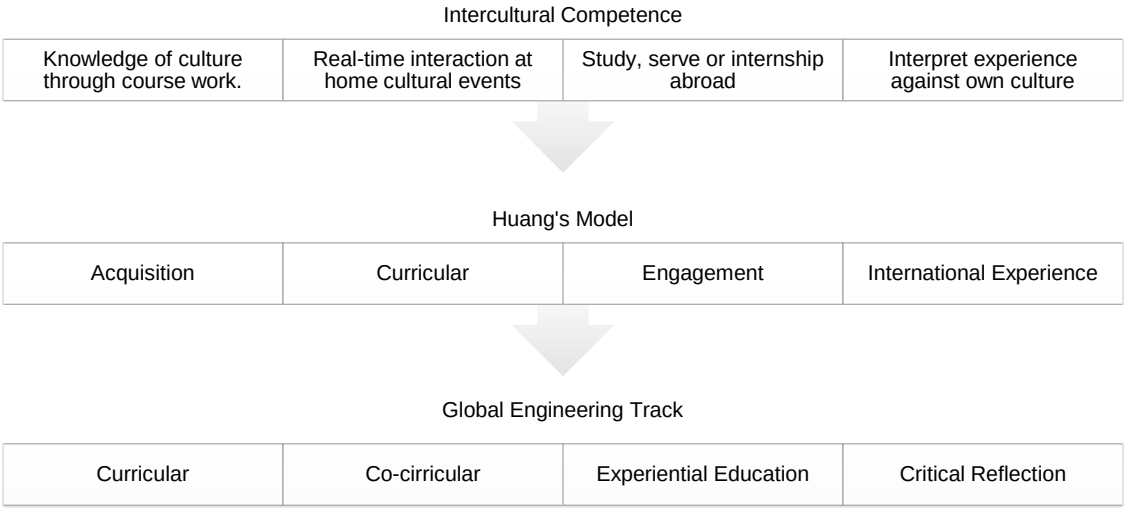

Figure 2. A comparison of Huang's intercultural competence program, intercultural competencies, and the Global Engineering Tracks cultural intersections.

Deardorff et al. (2012) provide another evidence-based review of the development of intercultural competence in students. The author determined that intercultural competence is ongoing and the assessment of intercultural competence in programs should include reflection, as it is important for students to assess their development from the experience; second, critical thinking, as students need to have the ability to acquire and evaluate knowledge; third, attitudes that need to be a part of the assessment in order to measure openness and curiosity which leads to learning; and finally, the ability to move from the perspective of self to that of others and to understand their world-views (Deardorff et al., 2012). Given this foundation, Figure 3 shows how Deardorff's finding validates the global track stages in the development of intercultural competencies.

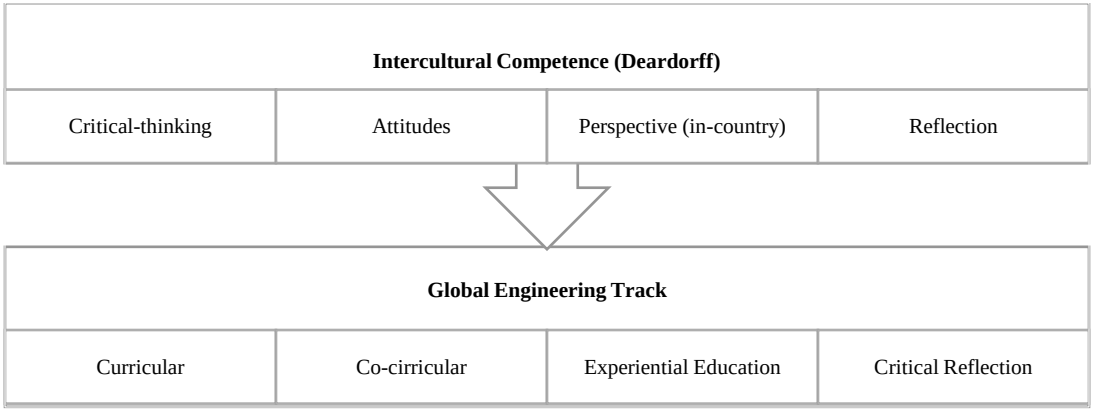

Figure 3. A comparison of Deardorff et al. (2012) intercultural competence assessment and the Global Engineering Tracks cultural intersections.

Curriculum and co-curriculum activities are ways Deardorff et al. (2012) see institutions developing intercultural competencies in students. Internationalizing the curriculum in programs like a Global Engineering Track offers these activities. Co-curriculum enhances local-global activities for cultural immersion, as experiential education offers education abroad experience, and critical reflection sheds light on the student's intercultural knowledge, skills, and attitudes. Deardorff et al. (2012) add that education abroad found in experiential education is yet another mechanism to develop intercultural competence, as the interactions promote cultural responsiveness, multi-cultural learning, and the recognition of diversity.

Intercultural competence can also be achieved through "internationalization at home," as Nilsson (2003) notes. The global track does not require engineering students to travel abroad. Students participate in curricular and co-curricular learning opportunities in the community, on campus, and in social settings where diversity manifests world-views and comparative perspectives that often challenge a student's

presuppositions. The mission, according to Deardorff et al. (2012), is to ultimately foster the understanding of others' perspectives and to graduate global-ready students.

Global Citizenship as a Learning Outcome. Global citizenship introduces the extent to which international education such as study abroad promotes concepts of global awareness and knowledge, both acting as attributes of global citizenship. Students develop this sense of cultural differences once they understand the constructs related to social and global civic responsibilities. Lilly et al. (2017) argue that becoming a global citizen is complex and multiple variables play a role in becoming interculturally competent, noting that participation towards becoming a global citizen is fluid. Gabowski et al. (2017) assert that global citizenship has three key dimensions: social responsibility, global awareness, and civic engagement. Furthermore, the authors add that cultural differences and acceptance of cultural diversity are central tenets required for global citizenship.

Soria and Troisi (2014) suggest that global constructs and cultural development can be informed through interaction with international students, lectures, conferences, and service-learning with a global focus which not only mirrors but indeed validates how the Global Engineering Track holds co-curricular requirements. Bennett (1986) adds that travelogues, history lectures, or other areas of study can also serve as co-curricular activities acting as entry into global citizenship. This useful variety is one reason co-curricular activities are a requirement in the track. Global citizenship facilitates the recognition of commonalities of cultures. It requires students to accept and integrate cultural differences to expand one's worldview.

Intercultural Sensitivity as a Learning Outcome. Bennett (1986) designed a Developmental Model for Intercultural Sensitivity (DMIS) as a framework of orientations to measure intercultural sensitivity along a spectrum of six stages, divided into two categories: ethnocentrism and ethnorelativism (Figure 4). Bennett's framework explains how one construes intercultural competencies and becomes increasingly sensitive towards cultural differences (Hammer et al., 2003).

Ethnocentrism	Denial	Disinterest in recognizing differences
	Defense	Own beliefs and behaviors better than others
	Minimization	Faulty assumtions about similarities in cultures
Ethnorelativism	Acceptance	Mentally agree that other cultures are equally valid
	Adaptation	Take on new beliefs and behaviors in addition to your own culture
	Integration	Move in and out of different cultural worldviews

Figure 4. Bennett's Developmental Model of Intercultural Sensitivity

This model is developmental in nature and promotes stages of growth from denial to integration. Each category contains three stages that represent a level of cultural perspectives and labels how one confronts cultural differences. Ethnocentrism submits that one's own culture as central to reality or "the way things are" and breeds disinterest in recognizing other cultures (Ventura, 2012, p. 4). Ethnorelativism, on the other hand, submits understanding one's own culture is one among many that exist.

Downey et al. (2006) add to this spectrum too by stating that institutions need to define what the problems are within cultures that need addressing, and by articulating to what extent global competency adds to engineering education. The author reasons that U.S. students tend to follow an ethnocentric perspective and "highlight similarities across cultures while minimizing differences" (p. 108). In a case study by Lafave et al. (2015), the researchers found that 56.3% of male students and 31.3% of female students scored low in intercultural sensitivity, meaning that the students tend to deny the presence that cultural differences even exist. This perspective of self-understanding (ethnocentric), as opposed to the understanding of others (ethno-relative), reveals the need for students to cultivate a desire to integrate and adapt to cultural differences.

Intercultural Authenticity as a Learning Outcome. Intercultural authenticity is defined by this researcher as a form of "cultural existentialism," an ontological behavior that one adopts over the longer term and through cultural encounters. This researcher presents the idea that Intercultural Authenticity is by definition "the perspective to understand how to behave, think, work, and live appropriately in a culture different than one's own." Table 4 shows the defining characteristics of each anticipated outcome that informs the definition and how each outcome plays a role in promoting different competencies towards authenticity. Once students engage in an activity or experience in each stage of the Global Engineering Track, students begin to draw upon, discover, explore and honor new cultural distinctions that ultimately promote cultural existentialism.

Table 4 Defining characteristics of outcomes that shape Intercultural Authenticity.

Anticipated Outcome	**Shared Cultural Characteristics**
Global Citizenship	*Live*, *think,* aware of social and civic environment
Global Competence	*Skill, behave, live, work, perspective* change, value
Intercultural Sensitivity	*Behave*, equality, adapt, integrate, *perspective* change
Intercultural Competence	*Behave, think, work,* communicate, *skill*
Intercultural Authenticity	*Skills, behave, think, work, live and change perspective*

Once engineering students are exposed to or participate in internationalized curriculum and education abroad experiences, cultural encounters will transform these characteristics and develop constructs from the learning experience that form new identities (Lilley et al., 2017). Dolby articulates an impactful statement about how students become authentic global engineers from experiences (as cited in Downey et al. (2006) who argues "the most important encounter in a study abroad experience is actually with oneself" (p. 111). Change actually takes place when students critically reflect on their experiences and challenge their presuppositions.

According to this researcher, engineering students in the Global Engineering Track become interculturally authentic as they participate across all four cultural intersections of experiences and activities. Students gain strands of cultural characteristics within global competence, intercultural competence, global citizenship, and intercultural sensitivity that alter their behaviors and attitudes. They acknowledge cultural differences and shift their perspective from self to one that focuses on others. Intercultural authenticity is reached when one critically reflects and challenges their presuppositions; integrates cultural differences into their decisions; and, crosses cultural boundaries with intention.

Interculturally authentic engineering students focus on other ways of knowing, doing, and solving complex problems. This paradigm shift leads them to become more culturally engaged and to gain the ability to make meaning of their experiences which incites self-authorship. This researcher further posits that an interculturally authentic engineering student holds five important characteristics: a sense of awareness, empathy, mindfulness, constructivism, and existentialism. These characteristics represent a cognitive dimension that allows students to understand the common behaviors of another culture while gaining the ability to successfully interact with that culture.

Given this description, one can look at frameworks such as Bennett's Developmental Model of Intercultural Sensitivity (Bennett, 1986) and understand to what point experiences such as study abroad have the ability to foster an engineering student's desire to accept, adapt, and integrate cultural differences toward becoming authentic. According to Ventura (2012), understanding these stages of change is an important aspect used in designing and implementing global programs as it answers the questions of where students are at in their intercultural understanding and where do educators ultimately want them to be.

In developing global education programs with an approach that fosters intercultural authenticity, educators should consider authentic learning. Knobloch (2003) for variety, introduces authentic learning as a constructivist approach, as he asserts that students gain authenticity through tasks and activities that are meaningful and attached to real-life situations outside of the classroom. The author continues to

stress authentic activities to promote the ability to solve complex problems in real-life contexts.

Perceived Student Learning Outcomes. Students participating in the Global Engineering Track and engineering education abroad experiences described their desire to travel, experience cultures different than their own, and learn how to become of a global citizen. In reviewing both applications for the global track and responses from students who traveled abroad, a theme of personal growth, professional development, and cultural exposure ran common. Each expressed their desires from different views and outcomes manifested themselves in various ways, but each sought the opportunity to challenge their presuppositions.

It was evident students wanted to live the course outside of the classroom and unintentionally began to move into an adult-candidacy state of maturing, even in short-term study abroad programs. Perceived student learning outcomes in this Action research study are meant to convey a student's expected outcome as well as their motivation from participation in the global track.

From Participating in the Global Engineering Track. Applicants to the global track must complete a questionnaire about their goals and motivation for entry into the program. Students are asked three questions: (1) Please describe your reasons for applying to the program; (2) Please describe how this program will fit in with your engineering career goals and plans; and (3) Please describe how you believe participating in a global engineering experience develops global citizenship. As of 2020, a total of 16 students have taken the entry survey and discussed their desires for

growth. Several subthemes emerged from the survey: cultural awareness, global citizenship, different engineering concepts, and new perspectives.

Many students stated a desire to "learn to solve engineering problems in a global context" and wanted to "contribute to the social, emotional, and cultural understanding of the world" as an outcome to the program. Other students added that the program will lead towards becoming a global citizen by preparing them for future opportunities by "becoming open-minded, diverse, and hold global awareness" in diverse cultures in engineering and around the world. For some students, it is an opportunity to get out of their comfort zone and "challenge their preconceived perspectives" or to "understand global engineering concepts" so that they can "solve engineering problems in a global context." One freshman student seemed to have summed up the value of a global engineering track by stating that "a global experience will help me empathize with people of diverse backgrounds and grasp the role engineering plays in global humanitarian, health, and environmental issues. This is the basis of global citizenship."

From Participating in Education Abroad Experiences. While students expressed their perceived outcomes from enrolling in the Global Engineering Track, it was the actual outcomes from 13 students participating in study abroad that validated the experiential education perceived outcomes. Students were asked three questions in an anonymous short-survey: (1) In regards to EDUCATION awareness, reflect on your time in ENGR 400 classes as well as the Shanghai Study Abroad experience. Briefly describe what aspects added the most value to your learning

during the in-country experience; (2) In regards to PERSONAL growth, briefly describe some unanticipated outcomes that were a result of the Shanghai Study Abroad experience; and (3) In regards to ENGINEERING awareness, briefly describe how participating in the Shanghai Study Abroad experience will impact your role as an engineer in solving problems. This researcher found a consistent message across the study abroad experience in that it changed a student's perspective in engineering and about others.

> This trip, regarding my engineering awareness, is more of a stepping stone. It is going to open doors down the road for me to further immerse myself in global engineering. Already though, it has made me more aware of just how many different engineering perspectives exist.

> Definitely, the times when we could explore on our own or talk to our guides/guests. These experiences allowed us to be fully immersed and understand the culture we were living in. It solidified confidence in my ability to be self-independent…and well-diversified and able to look through different lenses.

Students tied practical outcomes to cultural existentialism as several students indicated study abroad allowed them to learn more about themselves. One student who traveled to China said: "I feel much more in tune with who I want to be as a person after this trip."

Due to the low number of students participating in the global track and the study abroad to Shanghai, the experiences described can no way generalize outcomes; however, it does inform leadership, as there are parallels between perceived outcomes from participating in the global track and actual learning outcomes from education abroad experiences. To measure cultural intelligence (CQ) as an outcome of the track, future pre-post surveys will incorporate industry standard exams that correspond to how cultural intelligence can be measured using cognitive and emotional domains of intelligence. These exams will be given to students prior to study abroad, on return from study abroad, and again six months after their experience. As an added form of validating their cultural sensitivity and career readiness, questions regarding future intercultural authenticity will be developed and added to the graduate survey. Furthermore, the alumni office will monitor the career paths of students participating in the track to determine if the anticipated outcomes were met longitudinally.

Limitations of the study

The Global Engineering Track takes into account that not all students will choose to participate in an education abroad experience but it does acknowledge students still have an interest in gaining cultural capital. Accordingly, its use of multiple activities across four stages was designed to foster culturally-centered outcomes acting as cultural educational agents. Demetry (2007) postulates that an international experience itself is not a singular contributor in the development of intercultural competencies but rather one of many points of opportunity. Downey et al. (2006) (as mentioned in Anderson and Lawton, 2011) argue that study abroad

alone or exposure to new cultures found in forms of witnessed events abroad are not sufficient enough in the cultivation of improved cultural sensitivity. This is an accepted argument by this researcher and aided in the decision to develop four stages of the GET program.

Study abroad in the Global Engineering Track was developed with good intentions, however, one can argue that globally-focused pathways don't always take into consideration the extent of how authentic outcomes are sustained, to what extent they do not fit into a rigorous engineering curriculum, or how to justify costs of developing study abroad as it is a resource-intensive program that goes beyond line-item budgets (Anderson & Lawton, 2011). Study abroad is expensive for both the student and the institution (Anderson & Lawton, 2011; Rexeisen, Anderson, Lawton, & Hubbard, 2008). It holds demands of time and institutional resources that could be better spent on-campus or online, without adding costs to students while allocating resources to other globally centered programs outside of study abroad that achieve their desired objectives of learning (Anderson & Lawton, 2011).

Long-term impacts are often a result of studying abroad in regard to cultivating change in student ethnocentric views. To some extent, the development of intercultural knowledge from studying abroad still remains in question (Rexeisen et al., 2008). However, engineering schools today continue to heavily fund and develop new global affordances despite being able to justify the link between students gaining global competence and study abroad itself (Murphy, Dianna; Sahakyan, Narek; Yong-Yi, Doua; Magnan, 2014). Most impacts that are measured are done so immediately

and do not allow the necessary time needed to fully capture pivotal perspective changes in the cultural transformation that may have taken place longitudinally. The GET program falls into this same dilemma, and, due to limitations in funds, has not fully measured the outcomes from participating in the program. One limitation to consider is that since the two students who piloted program will not graduate until May 2021, measuring global competencies and long-term outcomes are challenged due to time.

There is much ambiguity that parallels study abroad with authentic outcomes in terms of student challenges, requirements to adapt to situations that require multiple solutions, and the ultimate end assessment of program development. Many institutions assess their global engineering programs through pre-post tests, Intercultural Development Inventory (IDI), or Global Perspective Inventory (GPI), to gain support for their study abroad programs, however, Rexeisen et al. (2008) argue that validation of the outcomes derived from study abroad using these designs show no lasting impact once students return to their conforming culture. The GET program does not have a formalized cultural assessment in place and measures partial results based on unvalidated pre/post-survey methods.

Rexeisen et al. (2008) examined results in their study from an acceptance/adaptation analysis and found no significant change in students' intercultural development which would indicate that minimum impact is made long-term as a result of study abroad. If there is only minimum impact, then the GET program should perhaps reconsider the value versus costs versus outcomes in its

continued development of engineering study abroad. Anderson and Lawton (2011) reported a study that showed how longer-term programs beyond a one-semester study abroad were more impactful on students. This is an area of growth that is limiting in engineering as study abroad beyond one semester is difficult due to its curriculum, particularly within a mandatary cooperative education program.

However, engineering students cannot perform study abroad beyond one semester due to their curriculum schedule. Students are limited in their curriculum schedules and adhere to a demanding exam structure that often conflicts with the culminating experience abroad. For instance, students participating in a spring faculty-led study abroad are faced with early final exams which often interrupt the curriculum schedule. Students are already limited in their curriculum schedules and adhere to a demanding exam structure that often conflicts with the culminating experience abroad. If this capstone is intended to show how students are being cultivated as globally conscious engineering graduates through study abroad, then long-term impacts and specific objectives need to be assessed and accredited (Anderson & Lawton, 2011) through the Accreditation Board for Engineering and Technology.

According to Anderson and Lawton (2011), there is little empirical evidence to support short-term (two weeks) study abroad or even semester-long program learning outcomes. The authors concluded that IDI and GPI should not be considered interchangeable when measuring outcomes in study abroad programs, as they measure contrasting dimensions in assessing the development or cultural growth of

students due to study abroad. If this distinction holds, then the claim that engineering students who participate in a spectrum of cultural intersections will likely walk away unculturable transformed from engineering study abroad.

Despite conflicting evidence, the epistemological outcomes garnered from a global engineering track and its global affordances seem to ensure global engagement is producing the desired global engineering student. This researcher adheres to the philosophy presented by Murphy et al., (2014) that study abroad is just one key ingredient across multiple cultural platforms as evidenced in this capstone and embedded in the GET program. This researcher also recognizes that due to a staggeringly low number of participants in study abroad in the US, institutions should develop programs and global affordances that surround how global competence develops "salutary impact on behaviors" (Murphy et al., 2014, p. 2) and ensure study abroad programs assume broader intercultural competence responsibility.

Potential Bias. This capstone retrospectively drew upon qualitative data gathered from student applications in the Global Engineering Track and from pre/post survey responses from students who participated in either an international service-learning or a faculty-led study abroad. In doing so, potential bias may exist as responses were subjective and unique to the student and the particular program. Since the risk of bias exists in most forms of qualitative research, bias may have occurred in the data collection and analysis as the researcher was a part of the education abroad experience with the subjects, the researcher was leading the data collection and the researcher may have influenced the respondents as the exposure and outcome have

already occurred. All questions in the pre/post survey remained unchanged and the Global Engineering Track application responses were free of selection bias at the time of application. Any culture bias based on this researcher's assumption and own cultural lens regarding student motivation was minimized as this capstone was cognizant of the researcher's cultural assumptions in regards to outcomes from participating in the internationalization of the curriculum.

Reflections

Leaning into the discomfort of being in a different cultural setting and learning new ways of solving difficult engineering problems is at the heart of global engineering. The importance of global engineering cannot be understated, and global affordances in engineering should be the expectation and not the exception. Global engineering education doesn’t always require a passport to learn about cultural differences. The Global Engineering Track presents a structured scaffold for engineering students who are seeking to gain cultural intelligence, both domestic and internationally. This action research study presented criteria, best practices, and how a global engineering track can be employed at an institution to internationalize their curriculum, even those with mandatory cooperative education.

Giving global affordances to engineering students towards developing existential intercultural authenticity is important and is the responsibility of an institution. This capstone presents ways in which a global engineering track can house cultural intersections that exist along a spectrum of development wherein a change in both perspective and self takes place through domains of curriculum, co-

curriculum, experiential education, and critical reflection. A structured global program that provides multiple cultural intersection entry points in domains is necessary to directly affect change in perspectives, intercultural understanding, and intercultural knowledge.

Reconceptualizing the typical engineering curriculum through a Global Engineering Track allows students to develop forms of cultural existentialism that intrinsically foster perception towards transformative change. Cultural capital for engineering students is significant, whether gained abroad or in a domestic setting. The transformational outcomes of understanding different ways of solving problems are found across a spectrum of cultural intersections. Intercultural development becomes a key domain for students to hold as a practitioner of engineering principles.

In regards to experiential education, participation in programs like the global engineering track using multiple platforms such as short-term study abroad increases global citizenship and open-mindedness as well as develops intercultural sensitivity (Gabowski et al., 2017). However, to develop an authentic global engineering graduate, educators should first look to develop authentic experiential learning contexts within activities that promote desired authentic learning outcomes.

In the end, in its simplest form, the conclusion of the capstone is twofold: First, a vast majority of engineering students gain meaning-making and cultural capital from the education abroad programs and activities. Second, developing global engineering students and programs requires collaboration, and the willingness to close the gap between complacency and innovation. Engineering leadership has the

power and potential to develop a global culture or climate that supports education abroad programs within their engineering school or college. It is a climate that either draws students towards developing culture capital or one that stays stagnate and withdraws from intercultural knowledge, allowing the ethnocentric views to remain unchallenged and changed.

The perspective presented in this action research study is particularly important for engineering schools that follow a four-year degree curriculum schedule with mandatory cooperative education, as most institutions offer little to no opportunity for students to participate in education abroad or gain exposure to intercultural activities. However, all engineering students, intentionally or unintentionally, gain some form of intercultural authenticity along the inter-cultural spectrum when participating in a singular experience or activity. Accordingly, this capstone posits that it is when students participate across multiple activities and experiences that perspective transformation towards becoming a more authentic global engineering student is adopted.

However, the notion that all engineering students will graduate with an understanding of global engineering perspectives and cultural intelligence is counter to reality, as the constraints of a rigorous curriculum are challenging, with most offering little to no structured programs to participate in education abroad (Grudzinski-Hall et al., 2007). Students who are exposed through participation in one or more cultural intersections or social encounters in an internationalized institution tend to form existential change much like participants in volunteer tourism.

Bennett (1986) looks at exposure to cultural intersections from a student perspective by recognizing that each responds differently to the experiences in the intersection and "do not respond directly to the event but rather to the meaning they attach to it' (p. 179). The meaning-making experience becomes so much more important as a developmental experience as it represents what can be termed as "experience difference" towards becoming culturally authentic.

Finally, it is important to consider that gaining global and intercultural competence as an engineering student is not a single activity, experience, course, but rather something that is developed throughout an undergraduate degree … it is a lifelong pursuit of the authenticity of self and engineering practice (Cecil, 2017). The value of providing global education affordances and intentionally structured pathways for engineering students without extending the time to degree is evident and should be a key strategy for internationalizing the curriculum and investing resources towards program development. There is considerable potential that a global engineering track can not only enable engineering students to gain cultural capital through education abroad experiences and cultural intersections but also produce a global engineering student who has the capacity to authentically lead others with a culturized engineering vision.

This goal of this Action research study was to demonstrate how one global program engaged engineering students in various culturally focused activities and experiences, despite being enrolled in a mandatory cooperative education program. It served to provide a proactive approach for engineering programs to further student

engagement in the internationalization of curriculum and the development of intercultural experiences. The research agrees with Lafave et al. (2015) that "it is possible to cultivate intercultural competencies in undergraduate engineering students" (p. 8) in the context of a global engineering track using the curriculum, co-curriculum, experiential education and critical reflection in pedagogical cultural intersections. Ventura (2012) sums up the view of this capstone by reminding educators that they must prepare engineering students to graduate with an understanding of a global economy. Institutions should not lose sight of the desired outcome from global experiences that prepare engineering students to enter a multicultural domestic workplace.

Capstone Project

Engineering students have a desire to travel abroad during undergraduate school but are challenged due to a tightly sequenced and content-demanding curriculum (Blumenthal & Grothus, 2008; Lohmann, Rollins & Hoey, 2005). This challenge is particularly true for students enrolled in a mandatory cooperative education engineering program in which academics and co-op are rotated over the course of a student's final six semesters. U.S. engineering schools are embedding comprehensive strategies into their curriculum to support a more internationally compatible degree program and meet the growing demand to graduate globally competent engineering students but at a slow pace.

In 2017, a Global Engineering Track was piloted at the University of Louisville, JB School of Engineering, to internationalize the engineering curriculum

in its mandatory co-op program. Students applied to be enrolled in the global track as an exception to the traditional co-op model. The Global Engineering Track allows an engineering student to substitute one of their mandatory co-op semesters with a semester of study abroad, and to count the semester as a rotation towards meeting their degree requirement. The Global Engineering Track requires a global diversity course to promote the understanding of cultural differences; service-learning on a local scale to foster cross-cultural awareness; an international experience to forge communication skill development; and, critical thinking in the form of reflection as a deliverable.

The Global Engineering Track as an internationalization strategy introduced engineering students to various dimensions and perspectives of global engineering through immersive academic, environmental, social and cultural lenses. The Global Engineering Track provides an opportunity for engineering students, of any major, to combine real-world global experiences with academic skills and activities. It is a program that focuses on dimensions of global engineering through environmental, social and cultural lenses that create a core of engineering students who embrace global perspectives and achieve cross-cultural competencies.

Highlights. The Global Engineering Track is designed to expose engineering students to multiple academic offerings that include global experiences to promote an understanding of the impact that engineering has on a global scale. It means to:

- Promote excellence in the learning of global engineering disciplines
- Promote student awareness of aspects of global engineering

- Promote educational track dedicated to global engineering dimensions, and to
- Generate student interest in global engineering opportunities

Examine engineering through a globalization lens and provide students an opportunity to explore, research, and immerse into an experience that is credited, systematic, and sustainable for learning. Using elements of cooperative (co-op) education for program participation, students will engage in multiple global engineering learning activities designed to enhance cultural competencies.

Criteria for Selection into the Track. The Global Engineering Track selection is highly competitive. Students who are interested in the track are encouraged to attend the information session on Global Engineering during the fall freshman semester and attend global engineering student interest activities such as Engineers without Borders. A student should apply prior to their first co-op rotation and before the end of their first semester with interviews and decisions being made by the end of January. Students must hold and maintain a 3.0 GPA, have some high school foreign language (conversational), and willing to embrace challenges not only with a strenuous curriculum but also with adding an international experience into their engineering major.

Program Description. There are many ways to gain international experiences in a mandatory cooperative education program. Global engineering opportunities include international service-learning, short-term faculty-led study abroad, semester abroad, and internships abroad. Students wanting to gain deeper cultural authenticity can participate in the new Global Engineering Track. The track exposes students to

structured globally-centered activities held across four platforms: curricular, co-curricular, experiential education, and critical reflection. Learning outcomes in each platform develop intercultural knowledge and cultural skills towards becoming a more authentic global engineer.

The Global Engineering Track consists of a structured set of globally centered activities performed across four stages of learning: curricular, co-curricular, experiential education, and critical reflection. The entry points represent what is described in Kolb's experiential learning cycle as "stages" in which distinct learning styles and alternative pedagogical approaches tie the experiences and critical reflection to student learning (Healey & Jenkins, 2000). Each stage, defined in this capstone as a cultural intersection, generates outcomes that aid students in developing intercultural sensitivity towards becoming a more authentic global engineer.

In figure 5, the Global Engineering Track can be conceived as a cultural development incubation period where exposure to cultural experiences begins to shape intercultural competencies through changes in perspectives. Over a period of time, the process of intercultural authenticity development takes place and becomes apparent once the students participate in all four stages of the track.

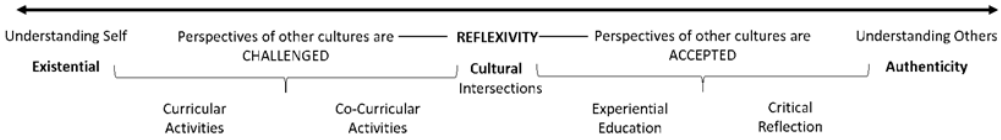

Figure 5. Global Engineering Track stages.

Students participate in activities and experiences that are both engineering and globally centered. Students maintain a portfolio that articulates: a personal plan to goal, documentation of activities, completed academics, advising checkpoints, and an overview of their final project. This pathway of global affordances is a form of internationalizing the curriculum in engineering.

Students must complete a set of intentional curricular, co-curricular, and experiential education activities over the course of six semesters with a final project summarizing learning outcome through critical reflection. All intersections hold an emphasis on the principles of engineering with a global focus and allow students to enter any cultural intersection at any point in their curriculum plan. The Global Engineering Track represents a conceptual framework that informs how education abroad programs fit into the broader context of mandatory co-op programs, and how cultural intersections can contribute towards the development of an authentic global engineering student.

The track is a self-nomination-based program that allows engineering students to participate in various structured touchpoints of international affordances that add cultural capital (Svensson & Wihlborg, 2010). The global track allows engineering students to substitute one mandatory cooperative education rotation for a semester-long study abroad. This openness provides the engineering student an opportunity to participate in education abroad experiences without extending their time to degree and remain within the constraints of their planned engineering curriculum.

Figure 6 shows the suggested timeline for students to participate in the program. The global track was created with the program fluency needed to provide engineering students an opportunity to participate in education abroad through structured experiences and become what Lilley et al. (2017) describes as an ethically thinking global graduate

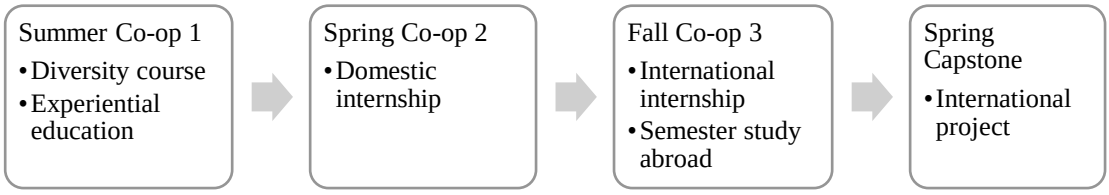

Figure 6. Suggested flight plan for students participating in the Global Engineering Track.

The Global Engineering Track model officially launched in Summer 2018, and now it allows every engineering student to participate in education abroad. It acts as a gatekeeper for short-term study abroad and international service-learning programs. Two major concerns that previously prohibited engineering students from participating in education abroad were resolved as a result of the global track. First, students had to overcome the inflexibility of an engineering curriculum in a mandatory co-op program. The track substitutes one semester of co-op for a semester of study abroad. Second, while there is student enthusiasm for international experiences, the lack of international affordances that fit into a cooperative education program has often prohibited students from participating. To address this lack of openness, the global track established preferred partners with third-party providers of

global education to support the logistics and administration and then launched a new short-term study abroad program over spring and summer breaks.

Launching an activity-based global track model that seeks to authenticate engineering student's experiences towards global citizenship still has challenges. Global programs are often developed using a piecemeal approach in which the curriculum and learning objectives are not informed by intercultural knowledge experiences and activities (Svensson & Wihlborg, 2010). The global track provides stages that move engineering students through a spectrum of cultural intersections with a conscious effort towards developing intercultural sensitivity. Engineering students heuristically gain intercultural competence and authenticity through structured meaning-making experiences.

Anticipated Learning Outcomes. The global track is a path for engineering students to pursue global activities and develop new perspectives towards other cultures, allowing students to better understand other 'ways of knowing' in engineering. The global track offers a process of moving students from understanding cultural terms from the lens of "self" to the intercultural understanding of "others" ("Intercultural Understanding," n.d.). In doing so, students follow a spectrum of what this researcher considers as intercultural development that transforms global perspectives as seen in figure 7.

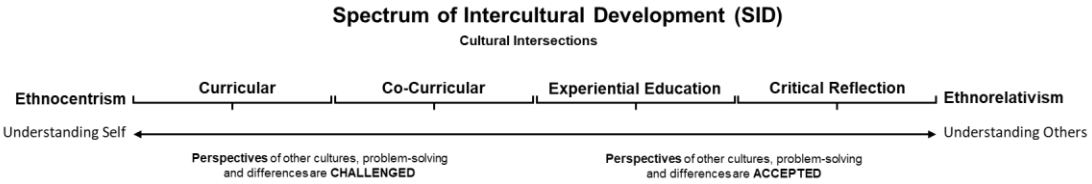

Figure 7. Cultural intersections in a spectrum of activities and experiences

Montuori and Fahim (as cited in Gabowski, Wearing, Lyons, Tarrant, & Landon, 2017) suggest it is this type of cultural exchange and exposure between other cultures and oneself that is pivotal in self-understanding and acts as a vehicle for perspective changes. The authors contend that having a cultural experience fosters more than global understanding; cultural intersections foster a greater understanding of self. Learning outcomes from the global track should surround developing programs that describe what a student should know, think, or be able to do once they are engaged in the track's activities or experiences. These cultural flows, as described by Svensson and Wihlborg (2010), link an outcome of having a deep understanding of other cultures with how an institution provides learning opportunities that advance knowledge through activities or experiences.

The Global Engineering Track was specifically developed around a mandatory co-op program to provide structured, formalized education abroad in a credit-bearing format whereby students who participate in the track do so intentionally with the desire of traveling abroad. However, defining the right combination of intercultural competencies needed to make up the fabric of a global engineering graduate is difficult as it includes understanding other cultures and

adapting to ‘ways of knowing’ beyond the classroom (Breunig, 2005). The success of this type of internationalization of curriculum for engineering students depends on building the global engineering track as an attractive internationalization piece where it promotes accountability for ABET accreditation and seeks strong evidence of global learning outcomes.

Conclusion. In the conclusion of this capstone, it is crucial to acknowledge that the most important consideration in the development of a global program is the student. It is their boldness, curious and uncompromising efforts, and global footprints that are challenging cultural boundaries in their efforts towards becoming more authentic global citizens and engineers. This capstone examined global engineering from a programmatic lens in regards to how internationalization of curriculum fits into an engineering program with mandatory cooperative education. More than anything, the internationalization of curriculum was found to be foundational in the development of multiple strands of intercultural competencies in engineering students. Educational learning theories were presented and weaved into a global engineering track in an effort to provide a model of cultural intersections that promotes and shapes forms of cultural existentialism and authenticity.

This researcher found that engineering students seek to learn outside of the classroom, abroad, and do so to make meaning of their experiences through identity work such as studying abroad. Ash and D’Aura (2013) point out that making small, impactful changes or a shift in one singular concept will lead to a domino effect of change simply by choosing high leverage starting points. By developing global

affordances in engineering, this action research project changed an institutional culture and gave life to the development of new signature global programs that will foster the internationalization of curriculum in higher education.

Reference List

Abes, E. S., & Hernandez, E. (2011). Critical and poststructural perspectives on self-authorship. *New Directions for Student Services, 133*, 97–108.

Albers-Miller, N. D., Prenshaw, P. J., & Straughan, R. D. (1999). Student perceptions of study abroad programs: A survey of US colleges and universities. *Marketing Education Review, 9*(1), 1–36.

Anderson, P. H., & Lawton, L. (2011). Intercultural development: Study abroad vs on-campus study. *Frontiers: The Interdisciplinary Journal of Study Abroad, 21*, 86–108.

Ash, P. B., & D'Aura, J. (2013). *School systems that learn: Improving professional practice, overcoming limitations, and diffusing innovations.* Thousand Oaks: Corwin.

Barber, J. P., & King, P. M. (2014). Pathways toward self-authorship: Student responses to the demands of developmentally effective experiences. *Journal of College Student Development*, *55*(5), 433–450. https://doi.org/10.1353/csd.2014.0047

Baxter Magolda, M. B. (2009). The activity of meaning making: A holistic perspective on college student development. *Journal of College Student Development, 50*(6), 621–639. https://doi.org/10.1353/csd.0.0106

Bennett, M. J. (1986). A developmental approach to training for interultural sensitivity. *International Journal of Intercultural Relations, 10*, 179–196.

Bennett, M. J. (2017). Developmental model of intercultural sensitivity. In

International Encyclopedia of Intercultural Communication. Wiley.

Bettez, D. J. (2004). Assessing engineering students ' study abroad experiences. In *American Society for Engineering Education Annual Conference & Exposition* (pp. 1–20).

Blackburn, G. A., Clark, G., & Pilgrim, D. (2005). The gap year for geographers: Effects and paradoxes. *Geography*, *90*(1), 32–41.

Blumenthal, P., & Grothus, U. (2008). Developing global competence in engineering. *OnlineJournal for Global Engineering Education*, *3*(2), 1–12.

Breunig, M. (2005). Turning experiential education and critical pedagogy theory into praxis. *Journal of Experiential Education*, *28*(2), 106–122.

Cecil, B. (2017). Chapter 7: Developing intercultural competence. Retrieved January 3, 2019, from https://www.naspa.org/constituent-groups/posts/chapter-7-developing-intercultural-competence

Christie, M.; Carey, M.; Robertson, A.; Grainger, P. (2015). Putting transformative learning theory into practice - ProQuest. *Australian Journal of Adult Learning*, *55*(1), 9–30. Retrieved from http://search.proquest.com.ezaccess.libraries.psu.edu/docview/1675860133?pq-origsite=summon

Clifford, V., & Montgomery, C. (2015). Transformative learning through internationalization of the curriculum in higher education. *Journal of Transformative Education*, *13*(1), 46–64. https://doi.org/10.1177/1541344614560909

Commander, N., Zhao, Y., Gallagher, P., & You, Y. (2015). Cross-national online discussions: international learning experiences with American and Chinese students in higher education. *Innovations in Education and Teaching International*, *0*(0), 1–10. https://doi.org/10.1080/14703297.2015.1006524

Davis, K., Tech, V., Knight, D. B., Davis, K. A., Tech, V., Knight, D. B., & Tech, V. (2018). Impact of a global engineering course on student cultural intelligence and cross-cultural communication, *1*(1), 1–39. https://doi.org/10.23860/jiee.2018.01.01.04

Deardorff, D. K., Wit, H. D., Heyl, J. D., & Adams, T. (2012). *The SAGE Handbook of International Higher Education*. Los Angeles: SAGE.

Demetry, C. (2007). *Work in progress - development of intercultural sensitivity from study abroad programs*.

Dirkx, J. M. (1998). Practice of adult education: An overview. *Journal of Life Long Learning*, *7*, 1–14.

Donnelly-Smith, L. (2009). *Global learning through short-term study abroad*. *Association of American Colleges and Universities*.

Downey, G., Lucena, J., Moskal, B., Parkhurst, R., Bigley, T., Hays, C., … Nichols-Belo, A. (2006). The globally competent engineer: working effectively with people who define problems differently. *Journal of Engineering Education*, (April), 107–122.

Gabowski, S., Wearing, S., Lyons, K., Tarrant, M., & Landon, A. (2017). A rite of passage? Exploring youth transformation and global citizenry in the study

abroad experience. *Tourism Recreation Research*, *42*(2), 139–149. https://doi.org/10.1080/02508281.2017.1292177

Gaia, A. C., & College, H. (2015). Short-term faculty-led study abroad programs enhance cultural exchange and self-awareness. *The International Education Journal: Comparative Perspectives*, *14*(1), 21–31.

Grainger, P., Carey, M., Christie, M., & Robertson, A. (2015). Putting transformative learning theory into practice. *Australian Journal of Adult Learning*, *55*(1), 10–30.

Grudzinski-Hall, M., Jellison, K. L., Stewart-Gambino, H. W., & Weisman, R. N. (2007). Engineering students in a global world: Lehigh university's global citizenship program. *OnlineJournal for Global Engineering Education*, *2*(1), 1–8.

Hammer, M. R., Bennett, M. J., & Wiseman, R. (2003). Measuring intercultural sensitivity : The intercultural development inventory. *International Journal of Intercultural Relations*, *27*, 421–443. https://doi.org/10.1016/S0147-1767(03)00032-4

Healey, M., & Jenkins, A. (2000). Kolb's experiential learning theory and its application in geography in higher education. *Journal of Geography*, *99*(5), 185–195. https://doi.org/10.1080/00221340008978967

Hendershot, K., & Sperandio, J. (2009). Study abroad and development of global citizens identity and cosmopolitan ideals in undergraduates. *Current Issues in Comparative Education*, *12*, 45–55.

Huang, L. (2017). Co-curricular activity-based intercultural competence development : students ' outcome of internationalisation at universities. *Innovations in Education and Teaching International*, *54*(3), 184–193.

Intercultural Understanding. (n.d.). Retrieved January 3, 2019, from https://www.australiancurriculum.edu.au/f-10-curriculum/general-capabilities/intercultural-understanding/

Jibeen, T., & Khan, M. A. (2015). Internationalization of higher education: Potential benefits and costs. *International Journal of Evaluation and Research in Education Journal*, *4*(4), 196–199.

Johnson, W. C., & Jones, R. C. (2006). Declining interest in engineering studies at a time of increased business need. Retrieved January 16, 2020, from http://www.worldexpertise.com/DecliningInterestin EngineeringStudiesataTimeofIncreasedBusinessNeeds.htm

Jones, S. R., Rowan-Kenyon, H. T., Ireland, S. M.-Y., Niehaus, E., & Skendall, K. C. (2012). The meaning students make as participants in short-term immersion programs. *Journal of College Student Development*, *53*(2), 201–220.

Kahn, H. E., & Agnew, M. (2017). Global learning through difference: Considerations for teaching, learning, and the internationalization of higher education. *Journal of Studies in International Education*, *21*(1), 52–64. https://doi.org/10.1177/1028315315622022

Kamdar, N., & Lewis, T. (2015). Deriving long-term benefits from short-term study-abroad programs. *The Journal of Management and Engineering Integration*,

7(2), 1–10.

Kato, M., & Suzuki, K. (2019). Effective or self-selective: Random assignment demonstrates short-term study abroad effectively encourages further study abroad. *Journal of Studies in International Education*, *23*(4), 411–428. https://doi.org/10.1177/1028315318803713

Katula, R. A., & Threnhauser, E. (1999). Experiential education in the undergraduate curriculum. *Communication Education*, *48*, 238–255.

Kerzmann, T. L. (2016). *Educational evaluation of a faculty-led education abroad program in re-newable energy educational evaluation of a faculty led education abroad program in renewable energy* (No. 15560). New Orleans.

King, A. (2011). Minding the gap? Young people's accounts of taking a gap year as a form of identity work in higher education. *Journal of Youth Studies*, *14*(3), 341–357. https://doi.org/10.1080/13676261.2010.522563

King, A. (2013). Recognising adulthood? Young adults' accomplishment of their age identities. *Sociology*, *47*(1), 109–125.

Kirillova, K., Lehto, X., & Cai, L. (2017). Tourism and existential transformation: An empirical investigation. *Journal of Travel Research*, *56*(5), 638–650.

Kishino, H., & Takahashi, T. (2019). Global citizenship development: Effects of study abroad and other factors. *Journal of International Students*, *9*(2), 535–559. https://doi.org/10.32674/jis.v9i2.390

Knobloch, N. A. (2003). Is experiential learning authentic? *Journal of Agricultural Education*, *44*(4), 22–34. https://doi.org/10.5032/jae.2003.04022

Kontogeorgopoulos, N. (2017). Finding oneself while discovering others: An existential perspective on volunteer tourism in Thailand. *Annals of Tourism Research*, *65*, 1–12. https://doi.org/10.1016/j.annals.2017.04.006

Kronholz, J. F., & Osborn, D. S. (2016). The impact of study abroad experiences on vocational identity among college students. *The Interdisciplinary Journal of Study Abroad*, *XXVII*(April), 70–84.

Lafave, J. M., Kang, H., Kaiser, J. D., & Asce, A. M. (2015). Cultivating intercultural competencies for civil engineering students in the era of globalization: Case study. *Journal of Professional Engineering Education*, *141*(3), 1–9. https://doi.org/10.1061/(ASCE)EI.1943-5541.0000234

Leask, B. (2013). Internationalizing the curriculum in the disciplines-imagining new possibilities. *Journal of Studies in International Education*, *17*(2), 103–118. https://doi.org/10.1177/1028315312475090

Lilley, K., Barker, M., & Harris, N. (2015). Exploring the process of global citizen learning and the student mind-set. *Journal of Studies in International Education*, *19*(3), 225–245. https://doi.org/10.1177/1028315314547822

Lilley, K., Barker, M., & Harris, N. (2017). The global citizen conceptualized: Accommodating ambiguity. *Journal of Studies in International Education*, *21*(1), 6–21. https://doi.org/10.1177/1028315316637354

Lim, S., & Bloomquist, C. (2015). Distinguishing service learning from other types of experiential learning. *Education for Information*, *31*(4), 195–207. https://doi.org/10.3233/EFI-150952

Lohmann, J. R., Rollins, Jr., H. A., & Hoey, J. J. (2006). Defining, developing and assessing global competence in engineers. *European Journal of Engineering Education*, *31*(1), 119–131.

Mayes, C. (2010). Five dimensions of existentially authentic education. *ENCOUNTER: Education for Meaning and Social Justice*, *23*(3), 28–37.

Mazzurco, A., Jesiek, B., K. R. (2012). AC 2012-4678 : Are Engineering Students Culturally Intelligent ?: Preliminary Results from a Multiple Group Study. In *American Socieity for Engineering Professionals*.

McDermott, P. (1998). Internationalizing the core curriculum. *Women's Studies Quarterly*, *26*(3/4), 88–98.

Mcneill, N., & Cox, M. F. (2011). *Global engineering programs: Identifying and supporting a diverse array of learning outcomes*.

Mezirow, J. (1991). *Tranformative dimensions of adult learning.* San Francisco: Jossey-Bass.

Mihelcic, J. R., Paterson, K. G., Phillips, L. D., Zhang, Q., Watkins, D. W., Barkdoll, B. D., … Hokanson, D. R. (2008). Educating engineers in the sustainable futures model with a global perspective. *Civil Engineering and Environmental Systems*, *25*(4), 255–263.

Mills, L. H., Deviney, D., & Ball, B. (2010). Short-term study abroad programs : A diversity of options. *Journal of Human Resources and Adult Learning*, *6*(2), 1–13.

Murphy, Dianna; Sahakyan, Narek; Yong-Yi, Doua; Magnan, S. S. (2014). The

impact of study abroad on the global engagement of university graduates. *Frontiers: The Interdisciplinary Journal of Study Abroad*, *24*, 1–24.

Nilsson, B. (2003). Internationalisation at home from a Swedish perspective. *Journal of Studies in International Education*, *7*(1), 27–40.

Norris, E. M., & Gillespie, J. (2009). How Study Abroad Shapes Global Careers Evidence From the United States. *Journal of Studies in International Education*, *13*(3), 382–397.

Olson, J. E., & Lalley, K. (2012). Evaluating a short-term , first-year study abroad program for business and engineering undergraduates : Understanding the student learning experience. *Journal of Education for Business*, *2323*, 325–332. https://doi.org/10.1080/08832323.2011.627889

Oxley, L., & Morris, P. (2017). What is global citizenship? Retrieved January 25, 2020, from http://www.oxfam.org.uk/education/ global-citizenship/what-is-global-citizenship

Pagano, M., & Roselle, L. (2009). Beyond reflection through an academic lens: Refraction and international experiential education. *Frontiers: The Interdisciplinary Journal of Study Abroad*, *18*(Ii), 217–229. https://doi.org/Related link: URL: <http://www.frontiersjournal.com/upcomingissues.htm>

Park, C. L. (2014). The meaning making model: A framework for understanding meaning, spirituality, and stress-related growth in health psychology. *Revista Pistis Praxis*, *6*(427), 40–47.

https://doi.org/10.7213/revistapistispraxis.06.001.DS01

Parkinson, A. (2007). Engineering study abroad programs: Formats, challenges, best practices. *OnlineJournal for Global Engineering Education*, *2*(2), 1–15.

Parkinson, A. (2009). The rationale for developing global competence. *The Online Journal for Global Engineering Education*, *4*(2), 1–17.

Patel, F., & Lynch, H. (2013). Glocalization as an alternative to internationalization in higher education : Embedding positive glocal learning perspectives. *International Journal of Teaching and Learning in Higher Education*, *25*(2), 223–230.

Raby, R. L. (2007). Internationalizing the curriculum: On-and off-campus strategies. *New Directions for Community Colleges*, (138), 57–66.

Ramírez, G. B. (2013). Learning abroad or just going abroad ? International education in opposite sides of the border. *The Qualitative Report*, *18*, 1–11.

Rexeisen, R. J., Anderson, P. H., Lawton, L., & Hubbard, A. C. (2008). Study abroad and intercultural development: A longitudinal study. *Frontiers: The Interdisciplinary Journal of Study AbroadThe Interdisciplinary Journal of Study Abroad*, *17*, 1–20.

Rickly-Boyd, J. M. (2015). Existential authenticity: Place matters. *Tourism Geographies*, *15*(4), 680–686.

Roberts, D. C. (2015). Internationalizing higher education and student affairs. *About Campus*, *20*(2), 8–15. https://doi.org/10.1002/abc.21186

Schubert, T. F., Diego, S., Angeles, L., & Jacobitz, F. G. (2011). Compact

international experiences: One path to expanding student international awareness through short-term study-abroad elective engineering courses. In *ASEE Northeast Section Conference* (pp. 1–12).

Shetty, A., & Rudell, F. (2002). Internationalizing the business curriculum: a small school perspective. *Journal of Education for Business*, *78*(2), 103–110.

Shuman, L., Besterfield-Sacre, M., & McGourty, J. (2005). The ABET "Professional Skills " – Can they be taught? Can they be assessed? *Journal of Engineering Education*, (January), 41–55.

Snee, H. (2014). Doing something "worthwhile": Intersubjectivity and morality in gap year narratives. *Sociological Review*, *62*(4), 843–861. https://doi.org/10.1111/1467-954X.12116

Steiner, C. J., & Reisinger, Y. (2005). Understanding existential authenticity. *Annals of Tourism Research*, *33*(2), 299–318. https://doi.org/10.1016/j.annals.2005.08.002

Sternberg, R. J., Bonney, C. R., Gabora, L., & Merrifield, M. (2012). WICS: A model for college and university admissions. *Educational Psychologist*, *47*(1), 30–41. https://doi.org/10.1080/00461520.2011.638882

Stoner, K. R., Tarrant, M. A., Perry, L., Stoner, L., Wearing, S., & Lyons, K. D. (2014). Global citizenship as a learning outcome of educational travel. *Journal of Teaching in Travel and Tourism*, 149–163. https://doi.org/10.1080/15313220.2014.907956

Stroud, A. H. (2010). Who plans (not) to study abroad? An examination of US

student intent. *Journal of Studies in International Education*, *14*(5), 491–507.

Svensson, L., & Wihlborg, M. (2010). Internationalising the content of higher education: The need for a curriculum perspective. *Higher Education*, *60*(6), 595–613. https://doi.org/10.1007/s10734-010-9318-6

Tarrant, M. A., Rubin, D. L., & Stoner, L. (2014). The Added Value of Study Abroad : Fostering a Global Citizenry. *Journal of Studies in International Education*, *18*(2), 141–161. https://doi.org/10.1177/1028315313497589

Taylor, E. (1998). Transformative learning theory — an overview. Retrieved June 9, 2019, from https://www.calpro-online.org/eric/docs/taylor/taylor_02.pdf

Tyran, K. L. (2017). Transforming students into global citizens: International service learning and PRME. *The International Journal of Management Education*, *15*, 162–171.

Ventura, J. D. (2012). Developing intercultural sensitivity through directed global education programming. In *2012 ASEE Northeast Section Conference* (pp. 1–7).

Walters, C., Charles, J., & Bingham, S. (2017). Impact of short-term study abroad experiences on transformative learning : A comparison of programs at 6 weeks. *Journal of Transformative Education*, *15*(2), 103–121.

Wang, N. (1999). Rethinking authenticity in tourism experience. *Annals of Tourism Research*, *26*(2), 349–370. https://doi.org/10.1016/S0160-7383(98)00103-0

Yu, H. (2012). A Study of Engineering Students ' Intercultural Competence. In *IEEE Transactions on Professional Communication* (Vol. 55, pp. 185–201).

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