Global Collaborative Engineering: Intercultural Skills Development, Study Abroad and Diverse Student Participation Considered?

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Globally Networked Learning Environments (GNLEs) allow for exposure to different cultures and international learning based on online communication and technology. This paper presents a case of GNLEs, the Global Collaborative Engineering (GCE) course, and explores facilitators' perspectives on the dimensions of intercultural skills development in students as well as their consideration of program conduct for students with diverse backgrounds as an alternative to traditional study abroad. Whereas both aspects are much discussed in research, they are not fully addressed and realized for the presented case. This is due to the specific academic, institutional and national higher education context that GCE is framed by. Suggestions will be made on how to change the status quo.

Keywords: GNLE, intercultural skills, study abroad, diversity

Introduction

Globally Networked Learning Environments (GNLEs), Collaborative Online International Learning (COIL) and their European sister concept of Virtual Mobility (VM)[1] (Villar-Onrubia and Rajpal 2015) have been said to have similar effects as traditional study abroad participation through physically moving to a different country and culture. Specifically, studies posit that students engaged in GNLE as an experiential learning format increase their content knowledge as well as their intercultural and transdisciplinary skills (de Kraker, Cörvers, Ivens, Lansu and Dam-Mieras 2007, Herrington 2010, MacLeod, Yang and Xu 2016, Op de Beeck and Van Petegem 2010, Tereseviciene, Volungeviciene and Dauksiene 2013, Villar-Onrubia and Rajpal 2015), all

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Globally-Networked Learning Environments (GNLEs), Collaborative Online International Learning (COIL) and Virtual Mobility (VM) have very similar definitions. COIL emphasizes experiential and collaborative student-centered learning as well as an engagement with learning content through different cultural lenses (State University of New York Global Center n.d.). VM encompasses a participation in networks facilitated by technology and connections to students and institutions abroad (Sweeney 2014) in order to enhance intercultural understanding and an exchange of knowledge (Bijnens et al. 2006). GNLEs link "students to peers, instructors, professionals, experts, and communities from diverse contexts" and "challenge students to negotiate and build shared learning and knowledge cultures across diverse boundaries" (Starke-Meyering and Wilson 2008, 2). I use Starke-Meyering's GNLE throughout this article bearing in mind the given similarity of concepts.

of which are also afforded by study abroad. However, some contest the assumption that intercultural sensitivity development in GNLEs takes place automatically and point to power imbalances due to English language dominance (Bégin-Caouette 2013) and the need to include opportunities for student reflection into the curriculum in order to prevent stereotyping and to attain the goal of intercultural understanding (Boehm, Kurthen and Aniola-Jedrezejek 2010).

What is more, many authors and policy makers discuss GNLE as a vital option for students who do not have the means or capabilities to physically move and study abroad (Marcillo-Gomez and Desilus 2016, Risner and Kumar 2016) thus broadening the scope of participation in institutional efforts to develop skill sets needed in students to work and live in a globalized world. Therefore, GNLEs offer the opportunity for "higher education institutions for a renewal of social responsibility within the university" (Wilson 2010, 187).

This paper investigates if and how the domain of intercultural skills development in students has been considered as a constitutive element by the academic facilitators who design and conduct the Global Collaborative Engineering Program (GCE) at a German institution of higher education together with partner universities in the US, Mexico and China. With regards to intercultural skills, there is a plethora of definitions in the literature. Bégin-Caouette proposes to conceive of these skills as the "knowhow, problem resolution strategies, flexibility, and empathy someone uses to understand, critically assess, and produce symbols to interact positively with people from other cultures" (2013, 56) as a synthesis of the scholarly work by Starke-Meyering (2005), Bennett (1986) as well as Behrnd and Porzelt (2012). For the given case, this definition represents the frame of reference for the above research question.

Furthermore, the question arises whether the inclusion of a more diverse student body that embraces those who would not be able to pursue traditional study abroad represents a motivation for the facilitators of the program. In this way, the study applies findings and theoretical considerations from previous research to the given case and broadens the base of the emerging body of knowledge on GNLEs and international collaborative online learning formats in general.

Global Collaborative Engineering Program: Case Study Description

The program under scrutiny evolved from the "Partners for the Advancement of Collaborative Engineering Education" (PACE), an initiative first introduced by General Motors as early as 1998 which currently comprises 54 universities in North America, Western Europe and Asia as well as further corporate partners like Hewlett Packard, Siemens and Oracle (PACE 2016, Anderl 2019). From this consortium, the Global Collaborative Engineering Program evolved in 2005 and has been realized annually among five universities in Germany, China, Mexico and the United States (two). On the program, small groups of undergraduate students (about eight per institution) engage in a six to seven week long project to design the frame and interior of a vehicle. For this task, the transnational cohort is divided into subgroups of three to four students in which each

nationality is represented. The subgroups are in charge of the design for one of the four national markets (the German, Chinese, Mexican and US). Each week, the self-directed group collaborations are supplemented with synchronous online video lectures by professors from each university and guest speakers followed by a discussion. The student teams compile a team agreement which outlines the online meeting structure, rules for communication as well as the synchronous and asynchronous internet applications and tools to be used for communication. Grading is based on self-study progress, team project progress and a final presentation (Global Collaborative Engineering n.d.). The student subgroups are supported by graduate students throughout the course of the program. On the German side, GCE is credit bearing and students can use the credits towards an elective course.

Methods

A qualitative research approach was chosen to gather insights into the perspectives of academic facilitators involved in the program. Specifically, I conducted a semi-structured interview with the German facilitators and analyzed four conference proceedings, articles and presentations by the German, American and Mexican academics who run GCE in their respective contexts. The textual sources were found via internet research. The given interview format was chosen as it renders a concise frame to the interviews while at the time same allowing for individuals' free elaborations. It thus suits well the exploratory nature of the study and provides insights into the opinions and perspectives of the ones involved in GCE design and conduct (May 2011). Data analysis for the case study encompassed both a content analysis of the transcribed interview and the aforementioned documents about GCE. Mayring (2002, 46 et seq.) points out that document analysis which entails the scrutiny of different materials like texts, films or works of art aims at interpreting the underlying thinking, feeling and acting behind their creation. It therefore also represents a suitable technique for generating insights into the given case. The analysis of information gathered from these primacy sources unfolded along categories and common topical threats about (the development of) intercultural communication skills, international team work, and student composition as they emerged from the contents. These were grouped together from the different sources and compared with each other and previous studies on GNLEs, COIL, virtual mobility and scholarly contributions on intercultural learning online. The findings are presented and discussed below.

Findings and Discussion

Intercultural Skills Development

GCE facilitators to some extent consider the dimension of interculturality in program design and conduct. It is mainly addressed by an initial lecture about cultural stereotypes and national cultural traits. The lecture also encompasses students' self-assessment as a member of their own culture and thus provides a platform for reflection at an early stage of the course. However, the development of intercultural skills is not an articulated GCE learning objective (Anderl and Bohn 2009). Furthermore, student subteams are requested

to compile a team agreement which defines the modes of interaction as well as technicalities like regular meeting time structure and the ICT applications to be used for audio/video communications. Herrington asserts the importance to foster team values in GNLEs which should comprise mutual respect, loyalty (in support), trust and diversity (2010, 528). The GCE team agreements therefore constitute an opportunity for individual and collective reflection about values, and social and cultural aspects at the start of the GCE program.

During the independent international teamwork phase, German facilitators reported that students would regularly encounter challenges concerning differences in mentality, and divergent ways of working and communicating among the international group of team mates. Differences ascribed to culture also unfolded around implicit expectations and team roles. With regards to the latter, German facilitators particularly emphasized that to them active engagement and leadership roles within the student subteams were determined by cultural backgrounds. In addition, facilitators from Mexico and the US note that language barriers and limited language skills of some of the participants represented challenges (Orta and Bohn 2009, 5). Furthermore, German facilitators stressed that it is the students' responsibilities to try and solve any evolving challenges about cultural differences on their teams independently and that they do not proactively check on or intervene in the group work unless subteams would not meet deadlines for subject-related group tasks. This expected independence reflects a simulation approach to real working life that German facilitators see as an overarching program goal. It also bespeaks a particular feature of German higher education culture. Students in German higher education are expected to act and work very independently (Pritchard 2004) and to be able to solve evolving challenges both in regards to academic contents as well as organizational issues in a proactive manner.

With regards to intercultural challenges, Kern (2000, 256) notes that exposure and awareness of difference can lead to a reinforcement of feelings of difference. In addition, "higher-level thinking and interaction" has been identified as a critical aspect in collaborative online learning projects since "[P]utting students in contact with one another does not necessarily guarantee intercultural learning, greater tolerance for diversity, or a reduction of stereotypical and ethnocentric attitudes" (Boehm, Kurthen and Aniola-Jedrezejek 2010, 140). In a similar vein, Villar-Onrubia and Raijpal emphasize that misunderstood intercultural interactions can lead to a reinforcement of stereotypes (2015, 80) and that generally the acquisition of intercultural skills or reaching mutual understanding does not take place automatically in the presence of diversity (76). These points have also been carved out by Boehm, Kurthen and Aniola-Jedrzejek (2010). What is more, Villar-Onrubia and Raijpal highlight the need to "implement mechanisms aimed at helping students reflect" on cross-cultural interactions (2015, 76). Given these insights from the literature, the question arises whether the instructional design of GCE with some guided reflection at its beginning and no reflection assignments, exchange or discussions with teachers and facilitators on cultural differences during the intercultural team collaboration phase runs the risk of (re-)enforcing stereotypes and negative attitude developments about fellow students from other cultures.

I would reason that GCE program design and facilitation is characterized by a limited consideration of the implications that interactions between students with different cultural backgrounds may have on the program. GCE has been defined and conducted as an online experiential learning format for students to gain insights into international project work in their academic field. Therefore, the program focus is not on intercultural skills development *per se* but rather on engineering design tasks completed by international student teams. This difference in focus is substantiated by Orta and Bohn in their concluding remarks on the organizational, technical and cultural challenges of GCE in saying "with commitment to a common task, cultural differences are not an obstacle" (2009, 7). Instructional and learning design therefore unfold around task-orientation and functionality, not an orientation towards interculturality. This finding coheres with the fact that intercultural skills development is not an explicit GCE learning objective. What is more, the status quo may be informed by the epistemic cultures of academic disciplines. Arguably, in technical fields there may be less a collective focus on social and cultural aspects, both in educational programing as well as in general, than in the social sciences and humanities. This statement is substantiated by Kumi-Yeboah (2018) who found in his empirical study on 40 instructors who design and teach cross-cultural collaborative online learning formats that those in the sciences significantly lacked intercultural awareness and did not consider an incorporation of diverse content and materials as a mechanism to acknowledge and integrate interculturality in their programs.

As a consequence, GCE holds a lot of potential as an online learning opportunity that comprehensively fosters intercultural skills development. Its potential, however, has not been harvested since the program start in 2004. This not only holds truth for the case of GCE as one instance of Globally-Networked Learning Environments. There is indication that GNLE instructors and facilitators in general tend to overlook the critical component of "culture" which leads to the fact that online intercultural communication oftentimes fails to achieve intended pedagogical goals (Boehm, Kurthen and Aniola-Jedrezejek 2010, 140). What is more, not fully accounting for the importance of culture and, subsequently, of guidance for reflection during the experience of cultural difference downplays the impact culture has on meaning (Herrington 2010, 530).

The issue of addressing challenges and conflict brought about by cultural differences and miscommunications in GNLEs as well as the overarching aspect of how much instruction and guidance students should receive on this topic in international online learning contexts touches upon a fundamental question: Should teachers and facilitators of GNLEs actively anticipate cultural challenges and provide for remedies where there is a threat of negative effects like stereotyping? And, moreover, why should they do so given that traditional study abroad experiences do not necessarily increase intercultural skills or reduce ethnocentricity either (Villar-Onrubia and Raijpal 2015)? I would argue that independent of the mode of intercultural exposure (online or physical immersion) there is the social responsibility to fully address potential intercultural challenges in order to avoid any negative consequences. It rests with institutions of higher learning and facilitators that conduct study abroad and GNLE programs to foster an appreciation of cultural diversity and capacities in students to positively deal with cultural differences in order to prepare them for global citizenry. This is even more true when considering that the internationalization of higher education can and should make a meaningful

contribution to society particularly in current times of political, social and economic unrest and environmental change (Brandenburg et. al 2019). Ultimately, the development of intercultural skills in GNLEs depends upon instructors' self-critical commitment to provide for intercultural learning opportunities that cultivate and enhance habits of reflection and self-critique in students (Boehm, Kurthen and Aniola-Jedrzejek 2010). What is more, they also hinge upon and are framed by institutional and national educational policies and cultures.

Study Abroad and Student Diversity

German facilitators do not conceive of GCE as a potential alternative to traditional study abroad. For them, study abroad encompasses a physical movement to another country for the duration of a whole semester. What is more, according to them German GCE students share their perspective. This reflects a typical conception in the German and European context. International semester exchange as set forth and stimulated by the European Commission's ERASMUS program in 1987 (Teichler 2009) has become a normative concept of international student mobility to such an extent that it has significantly contributed to producing a European identity (Mitchell 2012). Short-term study abroad, on the other hand, has predominantly emerged in the United States (Rhodes, Loberg and Hubbard 2014) and represents the norm and largest proportion in formats of international student mobility in American higher education (Stroud 2010). This may serve as an explanatory foil for the indication that American GCE facilitators consider international online collaborative learning as advanced enough to "not hamper the natural modes of interaction" and thus as viable alternatives to travel (Anderl and Bohn 2005, 1 et seq.) and physical presence abroad.

In addition, German facilitators did not believe that GCE could foster the development of intercultural skills mainly due to the short duration of the course. However, there is growing evidence that short-term study abroad experiences lead to positive outcomes in terms of intercultural appreciation, awareness and sensitivity (Anderson et al. 2006, Ismael, Morgan and Hayes 2006, Mapp, McFarland and Newell 2007) which illustrate that the temporal dimension of an international learning experience does not necessarily determine (the extent of) intercultural skills development. As elaborated above, instructional and learning design and particularly opportunities for student reflection are crucial.

Herrington (2010) carves out another aspect that supports the concept of GNLE and, subsequently GCE, as an alternative to study abroad. Students can apply knowledge to action only through experience as "the knowledge about global collaboration becomes real and comprehensible to them only after they have struggled with it in application" (2010, 522). What is more, part of the learning process in GNLEs for students is to understand how to adjust to unpredictability (525). These experiential learning features of GNLEs cohere with experiences gained during traditional study abroad. It is thus no wonder that many scholars relate GNLEs to traditional study abroad. Specifically, academic perspectives cast GNLEs as a preparation for (Risner and Kumar 2016), supplement of (Schreurs, Verjans and van Petegem 2006, Risner and Kumar 2016), or

alternative to (Op de Beeck and van Petegem 2010, Marcillo-Gómez and Desilus 2016, Tereseviciene, Volungeviciene and Dauksiene 2013) physical international student mobility.

Moreover, many writers are convinced that online international academic learning programs represent formats to provide opportunities to diverse students who could otherwise not participate in study abroad (Op de Beeck and van Petegem 2010, MacLeod, Yang and Xu 2016, Marcillo-Gómez and Desilus 2016). Diversity in these cases encompasses aspects like socio-economic and ethnic background, disability, or social obligations (like parenting or care taking). Similar to the conception of GCE as a study abroad alternative, higher education culture seems to also play a determining role in how GCE facilitators see and understand the program as a format to provide diverse students with an international learning opportunity and alternative to study abroad. The interviewed German facilitators neither think of GCE in this way at all nor have there been a larger number of diverse students participating in the program. In general, diversifying the student body as an institutional responsibility and part of institutional culture has only emerged fairly recently in Germany and is not comprehensively established in the country's higher education system (Klein 2016, Langholz 2014). As a result, the consideration of student diversity on the level of educational programing and execution has remained scarce which explains the given status quo as regards GCE. However, as with the dimension of intercultural skills development, there is much potential to systematically utilize the Global Collaborative Engineering project course as a viable alternative to study abroad and specifically for students with diverse backgrounds. This applies to Globally-Networked Learning Environments in general.

Implications and Conclusion

The Global Collaborative Engineering course is framed by norms and practices of academic disciplines, institutional cultures as well as general characteristics of the higher education system that it is situated in. Accordingly, this exploratory study has identified limitations which have emanated in the German context with some comparison to and substantiation from the US and Mexican context. The found limitations pertain to the instructional design and support for intercultural skills development in students and an understanding of GCE as an alternative to traditional study abroad for all students and particularly those with diverse backgrounds.

The empirical basis of this exploratory study is thin and thus there emerges the need to conduct further empirical research into both GCE contexts and other GNLE courses to substantiate the findings and learn more about the issues presented above. However, the presented findings allow for some recommendations for improvement and further research as regards the Global Collaborative Engineering course as well as international collaborative online learning formats and contexts in general. These address program design and execution as well as institutional policies and practices that frame international collaborative online learning environments. With respect to the development of intercultural skills and positive attitudes towards cultural "otherness" in students, tasks that stimulate individual and group reflection about differences in behaviors and attitudes

should be systematically integrated into the curriculum. In order to accomplish this, I would suggest with Risner and Kumar (2016, 290) a collaboration across disciplines by joining instructional designers, subject experts and those with expertise in developing intercultural skills. This would also generally result in broadening the epistemic perspectives on online project-based learning in engineering and science disciplines which arguably has entailed a limited awareness about aspects of interculturality on the GCE facilitating side as presented above.

Moreover, higher education institutions need to compile institutional guidelines and policies that render an interdisciplinary and structured approach to the design and implementation of GNLEs in order to fully come to terms with what MacLeod, Yang and Xu have called a "general lack of strategies for teachers to improve their implementation of cross-cultural online collaborative learning" (2016, 107). Furthermore, international collaborative online courses and projects do not need substantial funding for set up and conduct and hence typically represent bottom-up initiatives (de Kraker et al. 2007). Depending on the institutional context, guidelines and policies could thus help aligning individual GNLE initiatives with overall institutional educational and internationalization goals. Wilson (2010, 13) poignantly states that GNLEs are not solely technological innovations and therefore need innovative institutional policies which recognize faculty efforts and provide a mechanism to integrate them into the curriculum.

The provided arguments about guideline and policy development also apply to the issue of connecting international collaborative online learning with study abroad and student diversity. This is particularly true for Germany where study abroad is equated with semester long stays at a partner university and attention to the needs of student populations with diverse backgrounds has not yet become mainstream in higher education practice and policy. Institutional guidelines and policies could help foster close cooperation between global education offices, academic departments and student diversity offices to enhance the complete GNLE lifecycle with respect to integrating measures that design, promote and realize GNLEs as viable alternatives to traditional study abroad to diverse student constituencies. Ultimately, this could lead to a change in institutional culture, and support institutions resuming their social responsibility of providing opportunities for diverse students to develop a global mindset and global citizenship through diverse virtual and physical international learning programs.

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