PREPARING STUDENTS WITH KEY COMPETENCIES AND SKILLS FOR A GLOBAL LABOR MARKET: A CASE STUDY OF VIRTUAL TRANSNATIONAL LESSON DELIVERY THROUGH A GLOBAL SOFTWARE DEVELOPMENT PROJECT

Abstract

The global labor market poses challenges that necessitate the acquisition of new skills and competencies for employability in an inter-cultural environment. This includes soft skills such as communication, teamwork, partnership and collaboration. In this paper, we share our educational experience in planning and delivering a virtual transnational lesson to acquire these competencies through the implementation of a Global Software Development (GSD) project. This GSD project exemplifies a network of cross-border educational nodes, each of which acted as both a provider country and a receiver country in the experience simultaneously. We discuss the role of socialization and communication tools in collaborating and running this virtual lesson across various universities from different countries within different time zones. The lessons learned, in terms of preparing students for a global labor market in this manner, will be highlighted.

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1. Introduction

Globalization has long been a driving force for changes to educational systems. In the present era of globalization where competition has been intensified, universities worldwide are being challenged to deliver graduates who can be employed in an inter-cultural working environment. Prior research in [1] stated that globalization demands the graduates to be competent, not only to function professionally in an international environment, but also to be capable of making personal and public-policy decisions as citizens of an international society.

A survey in [2] reported that, from an employer's point of view, the top desired skills to help workers deal with the globalized world covered, for example, being up to date on new product development, foreign language skills, personnel management skills, and awareness of overseas matters. In [3], the skills that some employers claim as essential for those working in an international environment include the ability to learn, an adventurous spirit, creativity, curiosity, functional skills, initiative, language skills, a sense of humor, sensitivity, adaptability and flexibility, strong interpersonal skills, tenacity, and a willingness to take risks. These specific skill requirements are framed as 'global competency' [4][5][6]. Particularly in [6], global competency elements were grouped into international awareness, appreciation of cultural diversity, proficiency in foreign languages and competitive skills.

Many universities have been urged to foster global competency in their curricula. Prior research in [7] summarized the implications and demands of the global information society in an educational setting. Noteworthy among them include demand for widening the access to education for all, the creation of new educationally networked organizations, and demand for more flexible and general skills, such as problem solving, searching for information and continuous learning skills. There are several possible methods for preparing students with the key competencies and skills considered necessary for the global labor market. An extensive review in [8] summarized four basic approaches to integrating

internationalization competencies in higher education: the *activity approach*, *competency approach*, *ethos approach* and *process approach*. The activity approach deploys academic and extra-curriculum activities, such as attending international colloquia, field trips/visits to industry, student and faculty exchanges, international students and joint research initiatives. Unlike the activity approach, the competency approach focuses on the human dimension of internationalization rather than academic or organizational issues. The competency approach may result in developing new skills, attitudes and knowledge in students to make them competent for the global market. The ethos approach emphasizes developing a culture in universities that values and supports inter-cultural and internationalization matters. The process approach focuses on the integration of internalization as a process into the major functions of an institution.

Technical and vocational education (TVE) is one strategy for pre-employment skills development [9]. As part of TVE, student work experience as an intern, or as part of cooperative education or vocational training in a local community, is common. In addition, extracurricular activities, such as attending colloquia and field trips to industry, may be integrated with the university curriculum. In response to globalization, some universities have established international ventures for TVE, for example, the International Cooperative Education Student Exchange Program described in [10]. Similar efforts have been carried out at a nationwide level. Examples include work and travel USA by the Council on International Educational Exchange (CIEE) [11] and the international internship program by the International Cooperative Education (ICE) [12].

Although international internships and international cooperative education or vocational training are a great chance for students to gain multifaceted skills to succeed in today's global economy, the success of such international programs relies upon positive perspectives from international employers to recruit such students. More importantly, such programs are very costly and require substantial preparation, including the arrangement of travel, accommodation, visas and work permits. Therefore, acquiring international internships and international cooperative education can be difficult to achieve in practice, especially for students in developing countries.

This paper presents our educational experience in the delivery of a virtual transnational lesson as an alternative to an international internship and international cooperative education. It shares our lessons from a Global Software Development (GSD) project conducted in 2008. The GSD project exemplifies a network of cross-border educational nodes, each of which acted as both a provider country and receiver country simultaneously. Section 2 describes the setting of the GSD project. Section 3 explains the role of socialization and communication tools in collaborating and running this virtual lesson across various universities from different countries within different time zones. The lessons learned with respect to preparing students for global labor market are highlighted with our conclusions in Section 4.

2. Global Software Development (GSD) Project Setting

The aim of the GSD project was to engage the participating students in both acquiring and exercising the competencies and skills considered desirable for working in a global setting. The focal point of the project was to demonstrate that the quality of the work in a global setting relied on anticipation and communication between the stakeholders [13]. The GSD project delivered a transnational lesson on software development practice, virtually, across the borders of four different countries: the USA, India, Cambodia and Thailand.

The GSD project comprised five teams of student developers: two from the Computer Science Department of Pace University in the USA, one from the Department of Computer Science of the University of Delhi in India, one from the Computer Science Department of the Institute of Technology of Cambodia and another from the Department of Computer Science of Mahidol University in Thailand. The five teams competed to design and develop a software system, called

MultiLIB 2008, which was to be an electronic library system for the Computer Science Department of the Institute of Technology of Cambodia. An additional team of student clients in Cambodia supplied the requirements for the development of MultiLIB 2008.

Figure 1 depicts a simple view of the GSD project setting. The communication between the teams is bi-directional. That is, the country in which each of the universities participated in the GSD project acted as both provider country and receiver country simultaneously, through the collaboration and communication of all the professors and students engaged in the project. While the local professor guided each student team, they also received advice from the other professors remotely. Socialization exercises were also conducted to increase engagement, in which both the professors and students participated. More details of the GSD project setting and its evolution are presented in [14] [15] [16]. A collection of research findings from the GSD project can also be found on the project website: http://atlantis.seidenberg.pace.edu/wiki/gsd2008.

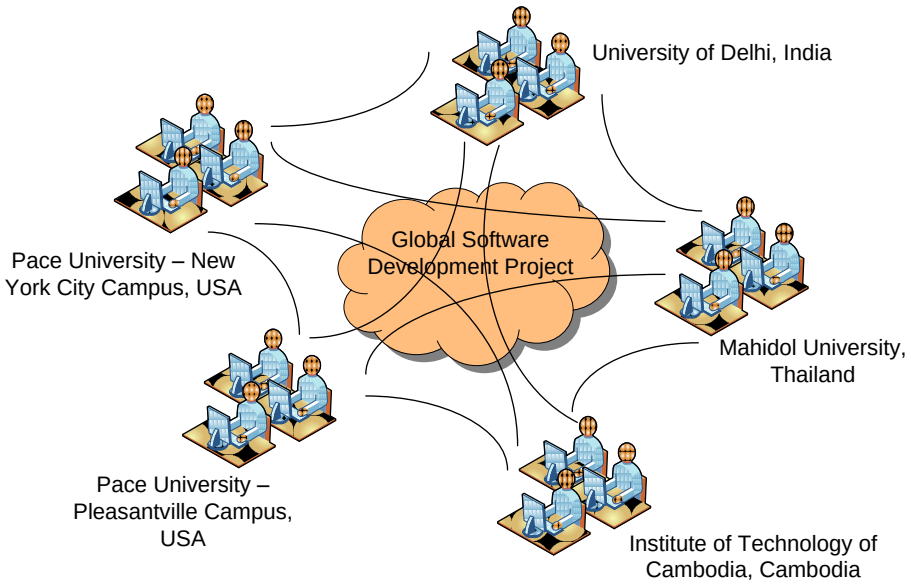

Figure 1. A Simple View of the 2008 Global Software Development Project Setting

The 2008 GSD project emphasized the practices necessary to acquire the competency and skills needed to prepare the students for international careers. Our prior work in [17] addressed the responsibilities and competencies desirable for the roles that the students need to play in a GSD project, as shown in Table 1. The roles are clients, client coaches, developers, developer coaches, software quality assurance managers and quality auditors. Besides the technical skills required for undertaking software development itself, the common skills and competencies required for every role in the GSD project are the interpersonal and communication skills

Table 1. Responsibilities and Competencies of the Main Roles in the GSD Project (Reproduced from [17])

Role	Responsibilities	Practice of Skills and Competencies
Clients	- Own and manage requirements - Solicit candidate software systems to meet the requirements - Conduct acceptance test - Select the systems that of highest quality to further deploy	- Analytical skills for problem solving - Negotiation - Project management - Feasibility study and project selection process - Interpersonal and communication
Client Coaches	- Mentor the client teams to baseline the requirements and manage	- Analytical skills for problem solving - Negotiation

	changes - Formulate test plans - Guide selection process	- Project management - Feasibility study and project selection process - Risk management - Conflict management - Interpersonal and communication
Developers	- Develop a software system to satisfy the requirements	- Analytical skills for problem solving - Negotiation - Design - Programming - Change management - Interpersonal and communication
Developer Coaches	- Mentor developers with project planning, analysis, design and implementation activities - Conduct code walkthrough to inspect coding problems - Review auditor comments and suggest to the developers how to improve the developed system - Review test cases and testability matrix diagram	- Analytical skills for problem solving - Negotiation - Change management - Conflict management - Quality management - Interpersonal and communication
SQA Manager	- Facilitate auditing process of quality auditors - Track and report project health check from feedback obtained from quality auditors	- Project management - Quality management - Risk management - Conflict management - Interpersonal and communication
Quality Auditors	- Independently check the processes and products of each development team - Provide feedback to assure and improve quality - Review the requirements document at regular periods	- Project management - Quality management - Risk management - Interpersonal and communication

3. Role of Socialization Tools and Communication Tools in Collaborating and Running a GSD Project

Considering that the 2008 GSD project ran across different time zones, the success of the project relied upon designing and using a suitable tooling environment. Four categories of tools were set up for the GSD project [16]. Firstly, *engineering tooling* was used for the software engineering tasks such as software modeling, design and coding. Secondly, *communication tooling* was used for information gathering and sharing between the GSD teams, predominantly using emails and chats. The GSD project also used a Wiki as the main communication channel at the organizational and team level. Thirdly, *socialization tooling* was used for engaging the students in the different GSD teams so as to get to know each other, as well as for engaging the students with the professors. This also made use of emails and chats, though part of socialization tooling was manual via traditional fact-finding questionnaires. The GSD project also experimented by conducting a virtual social event for its participants using Second Life, a free 3D virtual world where users can connect and socialize using free voice and text chat [18]. At the end of the project, all the students and professors were invited to join a virtual party on the Pace Second Life Island to celebrate their achievements together. Prior research on our findings of the impact of socialization activities in virtual world environments to global software development was presented in [19]. Finally, *project management tooling* was used for coordinating and managing the project across time zones, and included a shared Google Calendar.

Based on its tooling environment, the 2008 GSD project exercised both synchronous and asynchronous electronic communication tools in delivering its virtual transnational lesson. All the teams used asynchronous communication, mainly via emails, to exchange project information. Synchronous communication was used for critical software development tasks in the global setting. For example, each team was advised to chat electronically with the clients to validate the requirements, and to communicate likewise with its development quality coach on quality-related issues.

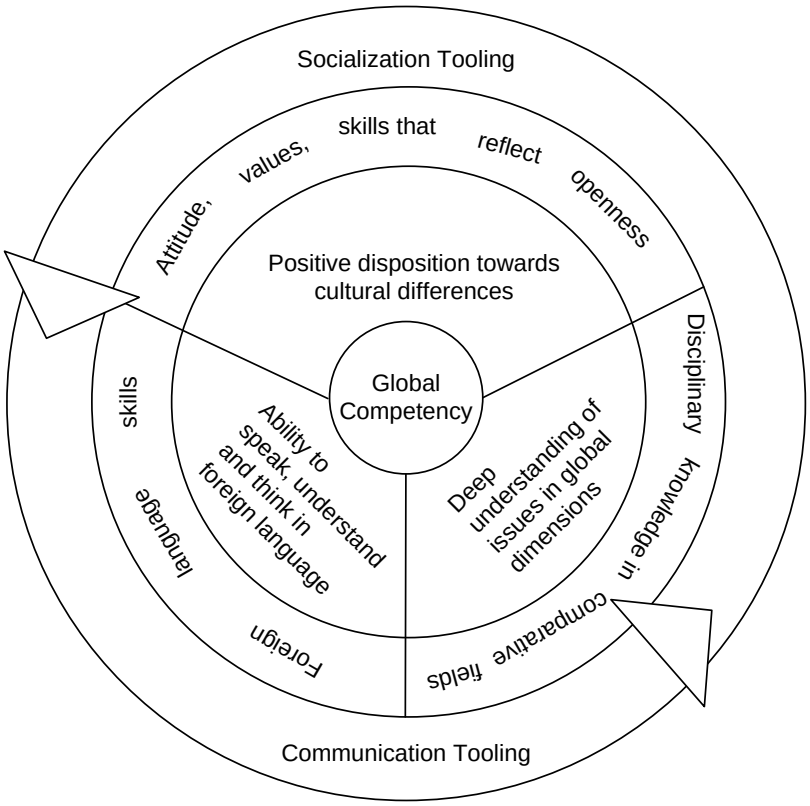

Figure 2. The Alignment of GSD Communication and Socialization Tooling with the Tri-Dimension of Global Competency

Figure 2 depicts the alignment of the GSD socialization and communication tooling with the tri-dimension nature of global competency and its development requirements as presented in [20]. The direction of the arrows illustrates the relative effects of both communication tooling and socialization tooling upon the global competency. Communication tooling is a key driver for the development of foreign language skills and it leads to the development of other competency elements concerned with socialization issues. The use of socialization tooling also feeds back into more use of the communication tooling. The more the participating students develop their social bonding, the more they communicate with one another [14].

Two games, a MapExercise and a FaceExercise, were carried out as part of the GSD socialization tooling to motivate the students to get to know each other. This paved a way towards openness for a positive disposition among the different cultures of the teams. The games also created an awareness of knowledge in comparative fields, such as the differences between the geographical locations, time zones, national holidays and local foods, all topics that provide a broader context for understanding some of the issues that arise in a global context. A crucial finding in the GSD project indicated that, to a certain degree, there was some relationship between the quality of the work delivered by each GSD student team and their use of communication and socialization tooling. Further details of this finding are discussed in depth in [14]. More results of these socialization exercises can be found at: http://atlantis.seidenberg.pace.edu/wiki/gsd2008/SocializationExercises.

4. Conclusions and Lessons learned

The 2008 GSD project exemplified an alternative strategy for virtual transnational lesson delivery, and may be considered as a viable part of a virtual international internship or international cooperative training. The readiness of students for global competition was acquired and exercised through their collaboration and communication in the GSD project. The GSD tooling environment was an important enabling mechanism for the students to learn and to practice the desirable skills and competency to enable them to work within an international team. From an internationalization point of view, the GSD project exploited both an activity approach and a competency approach to engage the students with global competency. The communication and socialization tooling also played a very important role in delivering global competency lessons to the students through their support for socialization exercises and group communications.

A similar initiative to the GSD project reported in this paper was presented as a "Distributed and Outsourced Software Engineering" course (DOSE) in [21]. The lessons learned from the work included how to organize distributed projects in an academic environment. Though both GSD and DOSE were similar in that both projects were run across many universities internationally, the GSD project focused more on eliciting the quality indicators resulting from various collaboration and communication patterns.

Although participating in the GSD project is not totally comparable to undertaking an international internship and international cooperative education abroad, our experiences suggest that this is an affordable way to equip and train students with essential skills and competencies required to work in an international setting. The other benefits of the GSD project included the reproduction of its teaching and learning model to better provide a learning-centered environment in a setting in which international collaboration is not possible, by integrating a role-based setting with problem-based learning [17]. The steps suggested for lesson preparation to gain some of the similar benefits of the global work in a co-located setting are presented in [17].

Obviously, the main difference between the GSD project and an international internship and international cooperative education is that, in the GSD setting, the students did not experience the physical and behavioral adjustments demanded of actually living and working in a different culture and society. Similar to an international internship and international cooperative education, however, an important success factor of the implementation of the GSD project was the academic networking between the universities involved. Creating an awareness of the importance and benefits of such a virtual transnational lesson, and gaining support from senior administration to run such a lesson, was critical to the very possibility and sustainability of this educational lesson delivery method.

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