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Interdisciplinary virtual multicultural teamwork project as an alternative to classroom teaching- Example of a pilot project funded by the EU

130 - Organizational response to globally driven Institutional Changes

Abstract

In today's globalized world and industry 4.0, flexibility in workplace and process oriented international virtual teamwork has become sine qua non for successful companies. Studies have shown that the employability of students coming from engineering and technical colleges depends on their soft skills. Yet these competencies are not usually addressed in engineering. In the diverse environment of the current labor markets, it is essential to promote teamwork and communication skills at an international level. The Multinational Undergraduate Teamwork Project was one of the projects chosen for funding by the EU as a pilot project to encourage the development of interdisciplinary and intercultural competencies of the students coming from different disciplines.

In the Multinational Undergraduate Teamwork course, students conduct a major project as members of an international team coming from different disciplines and different institutions. Apart from the kick-off and final meeting, students work in a virtual team and atmosphere. It is argued that this paradigm can be applied to any project or internship course unit. The results from the pilot programs support the authors' initial hypothesis that this innovative paradigm significantly promotes the development of soft skills in students.

Keywords:

Employability; soft skills; capstone project course; curriculum; intercultural competence

Introduction

Technological and social developments in the last couple of years have caused significant changes in the way in which people live and work. Internet, for example, has introduced a whole new variety of ways how people can collaborate in virtual teams across geographical and cultural borders (Odyzko, 2003). The implication of technological progress has the potential to shape our environment significantly. Fraunhofer Institute, for example, has termed this as the "Working Environment 4.0" based on a forecast of 100 experts (Fraunhofer IAO, 2014). This scenario describes the work and living environment of office and knowledge workers in the year 2025. It shows that in the knowledge intensive society of today, the capacity to be efficient, innovative and creative at the same time, is a crucial factor for success. Experts agree that the importance of these skills will increase due to the

new era of industry 4.0 (Frauenhofer IAO, 2014). An increasing number of people are facing highly flexible and multi-local forms of work in their daily life. Synergetic demands of individuals and organizations support this development (Guichard, 2001; Crites 1974).

A segment of students, who are particularly affected by rapid technological progress and increasing requirement concerning constant self-development and flexibility, are students from the IT sector (Karsenti, 1999). In 2010, the Association for Computing Machinery and the Association for Information Systems presented a revised model curriculum for undergraduate degrees in information systems (ACM, 2010). This model identified leadership, collaboration and communication as the basic components of knowledge and skills required in information system graduates. Modern economies are highly dependent on technology, requiring engineers to excel in collaboration and communication skills in international settings (Wieman, 2008). However, these competencies are not usually addressed in engineering and information science courses. One of the basic problems is how, in the context of universities and colleges offering technical courses, to create an environment which fosters the development of such skills.

The Multinational Undergraduate Teamwork Project (MUTW) is one such attempt to find a solution to the existing problem in technical and engineering institutions. Funded in the beginning as a pilot project by the EU, its main purpose is to test new pedagogical instruments to encourage the development of interdisciplinary and intercultural competencies of the students. In the Multinational Undergraduate Teamwork course, students conduct a major project as members of an international team coming from different technical, management and art disciplines and from different institutions and countries. Apart from the kick-off and final meeting, students work in virtual teams and scrum environment. Team members' backgrounds in terms of geography, are spread out to ensure that the teams are heterogeneous, and to promote international cooperation. The collaboration, which lasts a full semester, has the aim of developing and presenting a solution to a given problem. (Escudeiro & Escudeiro 2012). In addition to the opportunity of developing soft skills, the MUTW project is supposed to teach other competencies like, for example, applying the innovative scrum project management methodology (as in MUTW project in 2015) **Literature Review**

It is of extreme importance to assist the teaching community and to provide strategies on how participants can learn in an interactive virtual environment. These strategies should be more centered on the learners' projects and less in the transmission of content, which refers to the valorization of both the analysis and comprehension processes of the pedagogical methods and of students' learning processes (Simão, 2006). Based on the self-efficiency and results expectations, as well as on personal objectives, the authors of the career socio-cognitive theory have explained the influence which school and peer groups play in vocational development. They affirm that the peer group is a relevant source of information in bestowing meaning to the roles given in shaping, evaluation, performance and merit, ultimately contributing to the development of the individuals' vocational interests and values. The comfort models articulate the academic and professional objectives with the

other life roles and tasks (Lent *et al*, 2004; Super and Sverko, 2005), as is the case of the role of the student in academic work teams.

The quality of the student's adjustment to higher education is strongly associated with social support and with the resources made available by peers (Brooks and Dubois, 1995; Felner and Felner, 1989; Terenzini and Wight, 1996). In the last decades, the theoretical and empirical development around the social support have enabled researchers to define, understand and elaborate on the role of perception and social support as a strongly predictive factor of well-being (Antonucci and Israel, 1986; Cohen, 1988) and of individual adjustment (Cohen *et al*, 2000; Cutrona, 1986; Cutrona *et al*, 1994).

That is why MUTW projects concentrate on learning based on the team work assumption. The team research (Sharan and Sharan, 1992) assumes that the students are the ones to determine what they should learn and how to do it, given the learning capabilities of each individual team member. According to the authors "the goal of this organization is to create conditions to allow students, in collaboration with their peers, to identify problems, plan together the procedures needed to understand and cope with these problems, collect the relevant information, and in cooperation (though not necessarily collectively) prepare a report of their work, usually in some creative and interesting way".

According to the literature review outlined above, it seems that the improvement of the employability and communication skills of higher education students' would be an invaluable undertaking. It can be achieved with the help of a systematic and strategic teamwork deployment in an international and intercultural environment.

Hypothesis

Based on the above literature, it is hypothesized that the MUTW project results in visible improvement in communication skills (including intercultural communication skills), and the ability to work in virtual teams. Accordingly, the null hypothesis shows no impact of the MUTW project on the communication skills of the participants.

Implementation of the MUTW project/Testing of Hypothesis:

The hypothesis was tested by collecting data obtained by both quantitative and qualitative methodology as well as the interpretation of the data.

In MUTW project, the cooperative learning paradigm is used as the basic concept. Cooperative learning is instruction that involves students working in teams to accomplish a common goal, under conditions which include the following elements (Tapscott and Williams, 2008, Escudeiro & Escudeiro 2012):

1) *Positive interdependence*: team members are obliged to rely on one another to achieve the goal. If any team member fails to do their part, everyone suffers the consequences;

(2) *Individual accountability*: all students in a group are held accountable for doing their share of the work and for mastery of all the material to be learned;

(3) *Face-to-face interaction*: although some of the group work may be distributed and carried out individually, some must be done interactively, with group members providing one another with feedback, challenging each other's conclusions and reasoning. Perhaps the most important part of the interaction is teaching and encouraging one another.

(4) *Appropriate use of collaborative skills*: students are encouraged to help each other which teaches them the practice of development of trust, leadership, decision-making, communication and conflict-management skills.

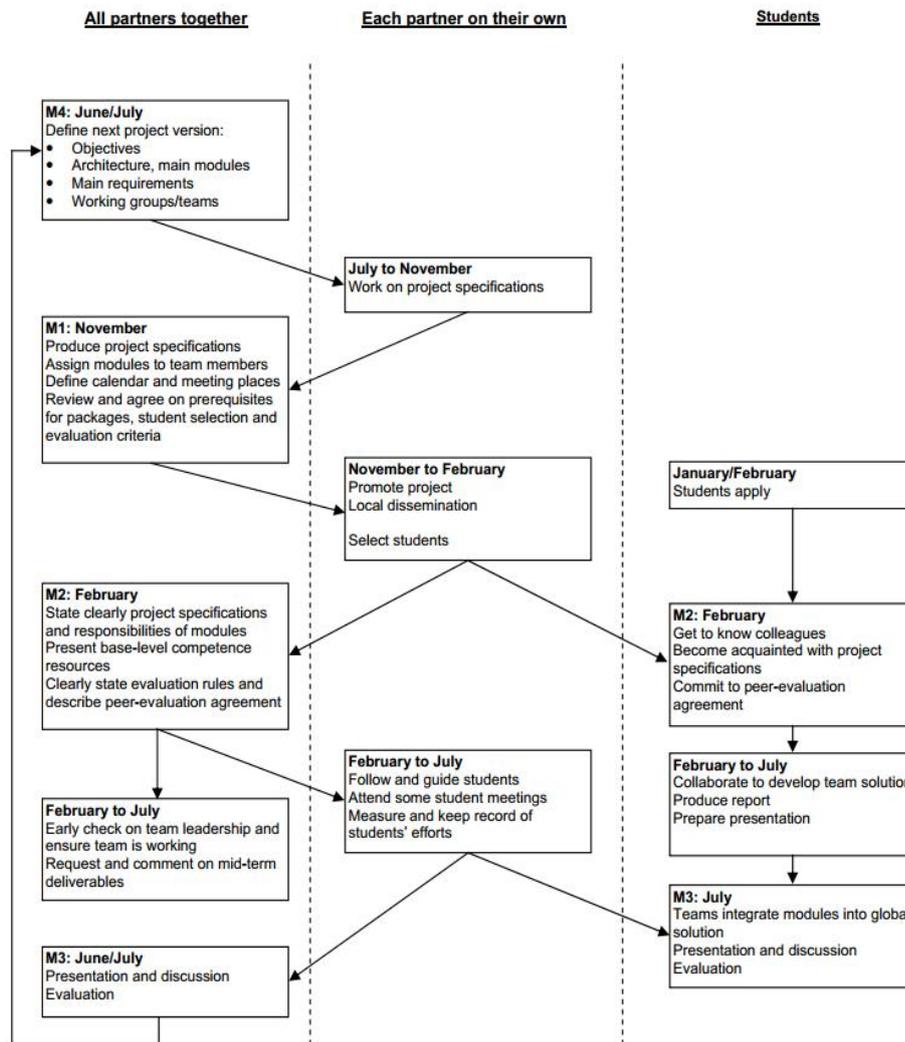
(5) *Group processing*: team members set group goals, periodically assess what they are doing well as a team, and identify changes they will make to function more effectively in the future.

The MUTW methodology (Figure 1) is based on the creation and management of international teams of students who will collaborate during a full semester, with the aim of developing and presenting a solution to a given engineering problem. For the pilot project, aimed at analyzing the hypothesis, students from 11 HEIs (Higher Educational Institutions) in 9 different countries were organized into two teams: the Orange team, which had 12 students, two from each of six institutions; and the Blue team, with 10 students, two from each of the other five institutions. The specifications of the problem presented to students – its architecture, main building modules and interfaces – were first described in brief by the group of partner institutions. Only the general operational rules were initially provided: students were required to interact and cooperate during the project in order to become familiar with other rules and protocols. At the end of the project, all modules had to be integrated and a fully operational system had to be presented.

Each team member was responsible for (a) developing a part of the whole solution; (b) justifying their technical options as an integrated part of the complete solution proposed by the team; and (c) collaborating with other team members to ensure that problems are solved within the agreed time and that all parts integrate to produce a unique solution. The team as a whole must produce a report and present the solution to the project jury.

Figure 1.

Multinational Undergraduate Teamwork and improving soft skills



Evaluation

Evaluating students and their progress throughout the semester and their final assessment were based on data collected from several sources, including a student feedback form, final grades and grading criteria, assessment questionnaires from the initial seminars on competencies, and finally, usage statistics derived from the groupware platform used.

The student feedback form is a questionnaire that students complete, together with a peer evaluation form, at the end of the MUTW course and immediately following their final presentation. The student feedback questionnaire contains both multiple choice and open questions (the latter so that students can offer narrative comments on MUTW). The peer evaluation form allows students to express their opinions on the commitment of their teammates and on the overall performance of their team. Grading of students in MUTW is done by an international jury and is based on a set of criteria previously

defined by the MUTW consortium. The grades achieved are, in part, a measure of the quality of the course and the extent to which students feel committed to it. This data is vital for the evaluation of the quality of MUTW as a course unit. Usage statistics provided by the online tools supporting communication among team members, the management of teams and the development of the final product were used mainly to confirm the commitment of the students to their teams. These statistical data served to confirm the perceptions obtained from students' supervisors as well as from the students themselves. The core data used in the current study came from the following sources: students' grades, peer evaluation and student feedback forms.

The data which was generated was then analyzed with the help of quantitative and qualitative methodology. Linear regression models were generated from feedback questionnaires and cluster analysis was done to test the quantitative data. Bardin's (2004) methodology was applied to the qualitative analysis, open-ended questionnaires and to content analysis. In this manner, the following results were obtained in the first and second pilot study (2009-2010, 2010-2011):

(1) MUTW improved teamwork skills due to academic/learning outcomes of the MUTW, personal outcomes and benefits from individual skills of team members; and (2) MUTW improved communication skills in an international setting due to the academic learning outcomes of the MUTW.

The main outcomes from cluster analysis highlight the following aspects:

- The overall evaluation by students of the project seems to be consistent and in agreement with the evaluation of specific aspects;
- Some students had particular problems with the project; however, that does not appear to have had an effect on either its overall or its partial evaluation;
- Of particular note was the support given by home institutions and the opportunity to benefit from an intercultural experience, both of which received positive feedback from all students;
- The groupware platform used by students to communicate during the semester seems to be perceived as a weak aspect of the project. The level of satisfaction with this variable is below the level of satisfaction expressed for other aspects of the project.

The subset of the questions asking students to rate their level of motivation and the level of their satisfaction with the project were analyzed in terms of academic background, language, job situation and location in Europe. This data showed that the majority of the students exceeded or matched their expectations in all dimensions.

Discussion of the results

Quantitative analysis of the results of the pilot project from 2009- 2011 has shown that this program has promoted soft skills without much change in the curriculum of the normal teaching (Escudeiro & Escudeiro 2012).

One of the basic assumptions of the MUTW project is the post- modernist concept that knowledge is created as a result of the co-construction of meaning within a group. This is the sine qua non for sustainable learning, as, it is based on lived experience. (Schwandt, 1994; Guba & Lincoln, 1994; Philips, 1995). Since students coming from different educational, social and cultural backgrounds meet on a virtual platform, learning takes place as a process of creation of new knowledge. This confirms the results of previous studies done in this area based on social constructivism (Spivey, 1997).

To conclude, this project shows not only how the process of learning takes place in a group, it also shows how cultural differences and a multidisciplinary approach can foster erudition of formal and informal skills.

References:

- ACM (2010). Model curriculum for undergraduate degrees in information systems. Retrieved 17.05 2015 from <http://www.acm.org/education/curricula/IS%202010%20ACM%20final.pdf>
- Antonucci, T. C. & Israel, B. A. (1986), "Veridicality of social support: A comparison of principal and network member's responses". *Journal of Consulting and Clinical Psychology*, 54, 432-437
- Bandura, A. & Schunk, D.H. (1981). Cultivating competence, self-efficacy and intrinsic interest through proximal self-motivation. *Journal of Personality and Social Psychology*. Vol.41 (3). pp. 586-598
- Brooks, J. H., & DuBois, D. L. (1995). Individual and environmental predictors of adjustment during the first year of college. *Journal of College Student Development*, 36, 347-360
- Cohen, Gottlieb & Underwood (2000). Cultivating Competence, Self-Efficacy and Intrinsic Interest through Proximal Self-Motivation. *Journal of Personality and Social Psychology*, 41, 586-598
- Cohen, S. (1988). Psychosocial models of social support in the etymology of physical disease. *Health Psychology*, 7, 269-297
- Crites, J. (1974). *Psicologia Vocacional*, Biblioteca de Psicología y Sociología aplicadas. Editorial Paldos, Buenos Aires
- Cutrona, C.E. (1986). Behavioral manifestations of social support: A microanalytic investigation. *Journal of Personality and Social Psychology*, 51, 201-208
- Cutrona, C.E., Cole, V., Colangelo, N., Assouline, S.G. & Russel, D.W. (1994). Perceived parental social support and academic achievement: An attachment theory perspective. *Journal of Personality and Social Psychology*, 66, 369-378
- EAEIE (2008). European Association for Education in Electrical and Information Engineering. Retrieved 17.05 from www.eaeie.org
- European Union (2015). EU funding. Retrieved 17.05.2015 from http://europa.eu/about-eu/funding-grants/index_en.htm
- Escudeiro, F. N. & Escudeiro, P. M. (2012). The Multinational Undergraduate Teamwork project. An effective way to improve students' soft skills. *Industry & Higher Education*. Vol.26 (4). pp. 279-290
- Felner, Robert. D. & Felner, Tweety. Yates. (1989). Self-Efficacy Mechanism in Human Agency. *American Psychologist*, 37, 122-147
- Fraunhofer, IAO (2014). Innovation Campaign Office 21 Research Period 2012-2014. Retrieved 17.03.2015 from http://www.office21.de/content/dam/office21/en/documents/innovation_campaign_office21_project_description_tcm1061-78842.pdf
- Giuchard, J. (2001). *Psychologie de l'Orientation*. Dunod. Paris
- Guba, E. G., & Lincoln, Y. S. (1994). Competing paradigms in qualitative research. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (pp. 105-117). Thousand Oaks, CA: Sage

- Karsenti, T. (1999). Student motivation and distance education on the web: love at first sight. Proceedings of NAWeb 99 International Conference on Web-Based Learning. Univeristy of New Brunswick
- Lent, R. W., Hackett, G. & Brown, S. D. (2004). Una perspectiva social cognitiva de la transición entre la escuela y el trabajo. *Evaluar*, 4, 1-22
- Lotman, Yuri. M. (1990). Universe of the Mind. A Semiotic Theory of Culture, I. B. Tauris & Co. Ltd.: London
- Moe N. B. & Dingsoyr T. & Dyba T. (2010). A teamwork model for understanding an agile team. A case study of a scrum project. *Information and Software Technology*. Vol. 52(5). pp. 480-491
- Odlyzko (2003). Internet traffic growth: sources and implications. Retrieved 17.03.2015 from <http://proceedings.spiedigitallibrary.org/proceeding.aspx?articleid=831584>
- Schwandt, T. A. (1994). Constructivist, interpretivist approaches to human inquiry. In N.K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (pp. 118-137). Thousand Oaks, CA: Sage.
- Sharan, Y. & Sharan, S. (1992). Expanding cooperative through group investigation. New York. Teachers College Press
- Spivey, N. N. (1997). *The constructivist metaphor: Reading, writing, and the making of meaning*. San Diego, CA: Academic Press.
- Super, Sverko. (2005). Social foundations of thought & action: A social-cognitive theory, Prentice-Hall, Englewood Cliffs, NJ
- Sewell, W. H. Jr. (1992). A theory of structure: duality, agency, and transformation. *Am. J. Sociol.*98:1–29
- Sewell, W. H. Jr. (1999). The Concepts of Culture. *Beyond the Cultural Turn: New Dimensions in the Study of Society and Culture*, Ed. by Bonnell E. V. and Hunt, Lynn. (1-35)
- Tapscott D. & Williams A.D. (2008). *Wikinomics – How Mass Collaboration Changes Everything*. Atlantic Books
- Terenzini, P.T. & Pascarella, E.T. & Blimling L. (1996). Student's out-of-class experiences and their influence on learning and cognitive development: a literature review. *Journal of College Student Development*. Vol. 37. pp. 149-162
- Veiga Simão, Flores. (2006). *Cooperar para aprender: Uma introdução à aprendizagem cooperativa*. Porto: Edições ASA
- Wieman, C. (2008). New university education model needed. Post on LiveScience. Retrieved 17.03 from <http://www.livescience.com/7528-university-education-model-needed.html>