

Internationalisation of Engineering Education: Experiences from Project Based Learning Environment

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Abstract

This paper discussed the influence of cultural differences on the learning experiences of students in intercultural group at Project Based Learning environment at Aalborg University. The data for this paper has been drawn from a PhD project which focuses on the learning experiences of students in intercultural groups. The background of this project is the internationalization of higher education and the emergence of innovative teaching and learning methodologies which emphasizes student centered learning.

Keywords: Project Based learning, internationalization, cultural differences, International students;

Introduction

With the increase focus on internationalization of higher education, the mobility of international student is increasing every day. A recent report from OECD report the enrollment of international students has doubled in last ten years (OECD, 2010). The other observed trend we can see in recent years is focused on more student centered learning methodologies at universities. Mainly the trend of enrollment of international student is from developing countries to developed countries (OECD,2010), while many western universities are shifting their paradigms from teaching to learning. One of the strategies is Project Based Learning (POPBL), where student work in collaborative groups. The objective of this project is to understand the learning experience of students with different cultural backgrounds to work in groups in POPBL setting.

“An Intercultural student group at project based learning at Aalborg University comprised of student from China, Denmark, Spain and Africa. They were all supposed to work collaboratively on a project. The International students just arrived from their home countries. Their first meeting was when they were asked to form a group together with a Danish girl. The first meeting went very well. Everybody was happy to know each other. They introduce each other and told each other about their countries, everybody was hearing each other’s stories with great interest. Before the end of this first dream meeting, The Danish girl suggested to make group rules. Initially other member got surprised what it means to make rules, Anyhow they started and agreed on a kind of strict rules. The Danish member was surprised to know their willingness for stricter rules! She also suggested agenda for next meeting. At the next meeting, which was actually first meeting on the project and was taking place in the project room. Nobody was there on fixed time of 8 am except the Danish girls. She was wondering about other group members. Until 10 am all members arrived and everybody gave some excuses. African and Spanish guys looked tired and they told that they were on party last night and could not wake up early. While the Chinese looked worried, initially he did not say anything, later he said he is worried about accommodation, the behavior of landlord, matters of local authorities (Kommune) and also missing his family back in China. Nobody was willing to sit in the group room to discuss project room. Danish girls mentioned about group rules, they were already broken, Danish girl could not talk more about group rules as the Spanish member said there are more important things than group rules, as a result this meeting end with the agenda for the next meetings, In next meeting again Spanish and African guys were not on time. They came with the same excuses. The group meeting started and nobody was prepared for the agenda except Danish girl again. The Danish girl was only speaking and telling about the specific details of the project. Later on Spanish feels its shame that it’s all the coming from Danish girls, he started to contribute, which Danish girls could not follow, as he was speaking such things which he even don’t know and it was non-academic arguments. In this whole process, the African guy took the headphone and start listening music while a Chinese member initially try to understand but later he too turned to his laptop and start writing emails and start browsing for new accommodation and part time job! Clashes started on the rules and regulation of the group. The Chinese never speak in the

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group room. He never understood the importance of group work. African member always expected that other members will do his work, while the Spanish feels, he should be not worrying about group work, as he is here just for one semester and grades will not be written on his Spanish diploma, he just needs to pass. He says he already knows nobody will get fail”

The above mentioned picture shows the importance of communication and interaction among the student and it is critical in the collaborative group activities during work. The importance of this competence is not only important in such learning setting but also for future employability.

1. Importance of Collaboration and Communication across cultures

Communication aspect is very important in the context of globalization, it is important in a cross cultural setting. Similarly, communicating with peers from other cultures makes its importance very critical to understand. The Accreditation Board for Engineering and Technology (ABET) and the National Academy of Engineering acknowledges that soft skills are as important as hard skills for Engineering. In soft skill emphasis is on cross cultural communication competence. In “Engineer of 2020: Visions of Engineering in the New Century”, the NAE acknowledged the competences as: ‘Given the uncertain and changing character of the world in which 2020 engineers will work, engineers will need something that cannot be described in a single word. It involves dynamism, agility, resilience, and flexibility. Not only will technology change quickly, the social-political-economic world in which engineers work will change continuously. In this context it will not be this or that particular knowledge that engineers will need but rather the ability to learn new things quickly and the ability to apply knowledge to new problems and new contexts’ (ABET,2006). According to Hofstede, the survival of humanity will depend to a large extent on the ability of people who think differently to act together (NAE,2004). Globalization is creating a context in which engineers from one culture need to collaborate and communicate efficiently with professional from other cultures. In this changing context of the engineering profession, the successful engineer will not be the one with only sound knowledge of science and technology, but also can understand cultural issues and has the ability to communicate and collaborate across the cultures Collaboration and Communication in intercultural environment are among some of the most needed professional competencies for engineering students. Globalization, Internationalization, ICT and interactions among different nations have put marked on the importance of intercultural competence and put pressure on engineering educational institutions to focus on it. On the other hand we can see the phenomenon of study abroad by student had increased and is increasing day by day (OECD,2010).

1.1.1. Intercultural Learning in international study programs

The ability to communicate in intercultural setting is considered as an important factor in international study programs and educational manger across the educational institutions are viewing that development of intercultural communication is one of the major element in the international education programs.(Piage,1993).

Paige’s Model of intensity factor in intercultural experience

In the analysis of intercultural experiences, Paige (1993) identifies 10 factors that can lead to psychological stress and deep emotions in education settings particularly and as a result influence the intercultural learning experience: (Piage,1993).

1. Cultural differences. Intercultural experience will be will be with mush psychological stress if the degree of cultural differences is higher among the participants in those settings.
2. Ethnocentrism. Ethnocentrism reflects in different ways, first the ethnocentric person himself and the less accepting attitude of the host for outsider put a stress on the sojourners.
3. Cultural immersion. The more immersed the person is in another culture, the greater the amount of stress.
4. Cultural Isolation. If a person is isolated by geography from members of his own culture, their experiences become more stressful.
5. Language. Persons unable to speak their native language will find those intercultural experiences more stressful and social isolation.
6. Expectations. Unrealistic expectations let down the person psychologically while interacting in intercultural situation
7. Visibility and invisibility. Persons who are physically different from others may become as object of unwanted attention or discrimination, sometimes one's identity is invisible for others can cause a stress in intercultural experiences, like political views, sexual orientation, religions.
8. Power and Control. A person in intercultural situations feels a loss of power and control over the incidents happening as compare to the power he holds in his own cultural setting, Psychological stress is associated with the loss of power.

9. Status. Feelings of the person in an intercultural situation about his status, it may include the feelings that a person is not getting the respect he deserve or unearned recognition.
10. Prior Intercultural Experience. A person with prior intercultural experience will be in the many comfortable situation compared to one without or very little background in intercultural setting will be in much stress.

The factors mentioned by Paige provide an understanding for the program coordinators to facilitating the intercultural learning experiences in international study programs.

3. Internationalization of Engineering Education

There is broad recognition that engineering education needs to change in order to meet the challenges of the knowledge society (UNESCO,2010). We are living in a changing society where events and innovations in engineering along with expectations of stakeholders involved have resulted in the globalization of engineering. Wulf reported several trends, which he feels characterize the globalization of engineering. Among them we notice: a vast array of new materials and processes, use of information technology, a need to have both specific technical knowledge and breadth of knowledge, a need for teamwork, and a rapid pace of change calling for lifelong learning (Wulf,1997).

The 21st-Century Engineer, A Proposal for Engineering Reform' cited in Parkinson, (Parkinson, 2007) addresses in detail the globalization issue in engineering. It states: 'A solid understanding of globalization is key to an engineer's success in today's global society. Globalization involves the ability to understand that the world economy has become tightly linked with much of the change triggered by technology; to understand other cultures, especially the societal elements of these cultures; to work effectively in multinational teams; to communicate effectively—both orally and in writing—in the international business language of English; to recognize and understand issues of sustainability; to understand the importance of transparency while working with local populations; and to understand public policy issues around the world and in the country in which one is working. It will be these fundamental capacities that will enable 21st-century engineers to develop into professionals capable of working successfully both domestically and globally, highly respected by the general public and regarded all over the world as professionals of the highest order'(Parkinson, 2007).

4. Project Based Learning

Problem based learning concept is an innovative learning methodology which is considered to be started from the McMaster University in Canada almost five decades ago. Initially it was used in the medical colleges. Problem and project based learning (PBL) is an educational strategy. An approach to organize the learning process in such a manner that the students are actively engaged in finding answers by themselves (Graaff, & Kolmos, 2007) In PBL, students work in collaborative groups to identify what they need to learn in order to solve a problem. The teacher acts to facilitate the learning process unlike a traditional teacher. The success of PBL is illustrated by the fact that since last couple of decades, this method has been introduced in many universities all over the different parts of the world. PBL is practiced in different ways in different parts of the world with different names. (Savin-Baden,2004)

It has different models like Savin-Baden (2000) concludes five models as: PBL for Epistemological Competence, PBL for Professional Action, PBL for Interdisciplinary Understanding, PBL for Trans-disciplinary Learning and PBL for Critical Contestability. (Savin-Baden,2004).

According to Hmelo-Silve the goals of PBL include helping students develop 1) flexible knowledge, 2) effective problem-solving skills, 3) self-directed learning skills, 4) effective collaboration skills, 5) intrinsic motivation (Hmelo-Silver, 2004) There are many research studies conducted to check the effectiveness of PBL also compared with other teaching methodologies. Recently Johannes Strobel and Angela van Barneveld (2009) employed a meta-synthesis method exploring the effectiveness of PBL is regarding of four categories: 1) non-performance, non-skill-oriented, non-knowledge-based assessment, 2) knowledge assessment, 3) performance of skill-based assessment, 4) mixed knowledge and skill-based assessment. They found that students and staff indicated greater satisfaction with the PBL approach to learning.

Dochy (2003) reviewed studies conducted in the 90s on PBL and his main conclusion is that the use of PBL has an impact on improvement of skills development such as process competencies or skills. The impact of knowledge acquisition is missing or not significant. . Also, according to Du (2006) PBL students do not acquire less knowledge compared to traditional educated students.

De Graaff and Kolmos (2003), formulated three common approaches which characterize PBL:1) learning approach is organized around problem, context and the experience of the students. 2) Content approach. 3) Social approach suggests that a majority of learning takes place in the group. So according to this approach learning, is social act where student not only learn from each other but also they also develop the collaborative learning.

In the context of Aalborg University the PBL learning principle is on problem-based project work. In this environment students spend more than half of the time in the groups and teams.

There is pressure on the universities to provide such a learning environment which does not only equip the students with the knowledge of their respective disciplines but also enhances their process competencies and prepares them for future challenges.

PBL provides an interactive learning environment in which group of students work together in the form of a team to achieve certain results of their relevant projects. In this whole process of one semester, they interact, collaborate, and discuss a lot. At the end of the semester, students are expected to achieve certain learning outcomes, which may include professional competencies such as communication and collaboration across cultures.

Aalborg University, which is known for the Problem and Project Based Learning (PBL) in engineering education, is in the context of this paper. This Aalborg PBL model is characterized for its group work.

5. Research Methodology

The scenario mention in the introduction part of this paper is not just an imaginary setting; rather it emerged through an organized data collection methodology, which is based on the qualitative paradigm of research design.

This paper is a part of a PhD project, for which a qualitative approach is utilized to understand the learning experiences of students with different background in a project based learning environment where much focus is on collaboration and communication.

As the objective of this study was to understand learning experiences of international student in the project based learning environment at Aalborg University. Much of the focus was on what happen when international students have to work in groups. How does international student develop and what factors are contributing in the learning process of students Since the objective of this paper was to explore, describe and interpret the transformative learning experiences of international engineering student in groups work specifically at Aalborg University, looking at the objectives and research question a qualitative approach was adapted to study international student.

To achieve the maximum benefits of qualitative methods the research process is extremely important; the research process involves planning of data collection, gaining access to participants, developing rapport.(Cresswell, 2008). The faculty of Engineering and Science at Aalborg University Denmark was selected as a site for conducting this research project. All students enrolled in this university have to work in project groups, in each semester as a part of their study program. Students are provided with group rooms. For this study Master level students were selected as an international students mainly get enrolled at this level. We have made some initial selection conditions for the selection of the student groups. The foremost condition was that there must be at least one international student in the project groups and each of the students must have an experience of at least one semester already at Aalborg University. In selecting the group, a detailed procedure was followed, which was conducting initial meetings with program coordinators. They were told about the research objectives and on their recommendations student groups were contacted. After the willingness of student groups, the observations of the student groups were started. We were able to select nine intercultural student groups. The more details of the students are in a table. 1.

Table 1. Composition of the student groups under observations

Group No	Nationality	M	F	Total	Group No	Nationality	M	F	Total
1	China	0	1	5	5	Romania	0	1	5
	Poland	0	2			Denmark	0	2	
	Germany	0	1			Germany	0	1	
	Bangladesh	0	1			Bulgaria	0	1	
2	Romania	0	1	5	6	Denmark	0	2	5
	Indonesia	0	1			Kenya	1	0	
	Germany	0	2			Czech	0	1	
	Denmark	1	0			Germany	0	1	
3	Denmark	2	0	5	7	Romania	2	0	5
	France	1	0			China	2	0	
	Romania	1	1			Nepal	1	0	
4	Denmark	3	2	7	8	India	1	0	3
	Spain	0	1			France	1	0	
	Italy	0	1			Romania	0	1	
5	Denmark	3	0	6					
	Australia	1	1						
	Germany	1	0						

6. Findings and Discussion

Data was collected by observing nine intercultural student groups, which includes 46 students from 17 different nationalities. Qualitative in-depth interviews (20) were conducted. Each student shared some of 'good' or 'bad' experiences due to the cultural differences in Project Based Learning Environment. Sense making of the students regarding good and bad experience were cluster around the themes of self-adequacy and others inadequacies.

In an effort to understand the influence of cultural differences in intercultural student group in the context of PBL learning environment in engineering education, this study explored those issues and challenges that students face in their group work during different collaborative tasks. Based on continuous observations and collecting viewpoints of the students by conducting interviews. The initial analysis suggests there are a few factors that influence the communication and collaboration in the intercultural student groups significantly:

6.1. *Motivation for Project Group*

In such an intercultural student group, each student is enrolled in this study programme with different expectations. That can be seen in the above mentioned picture.

6.2 *Expectations*

As the group members have different cultural backgrounds and varying prior learning experiences. They have different priorities during the group work, while the other group's members expect different contributions. The expectation of the supervisor is different than the way student work emerged during collaboration

6.2 *Dealing with Cultural differences*

One of the biggest challenges international students face in group work is to interact with students of different cultural backgrounds, many times mis-communication and negative perception emerged due to lack of information and the way of interaction due to different cultural backgrounds. We can sense this from the above mentioned example of the student experience. The problems of interaction with other students create anxiety for that student and it also influenced on the overall group learning process. On the other hand, students reported that their understanding about different cultures have improved due to group work experiences.

6.3. *Rules and regulations for Group work*

Students in intercultural groups show different behaviors towards the group's rules. Some took them seriously and act according to that, while for others they were just some written words.

6.4 *Peer Support*

There are two different perceptions present in the students and also in the literature. First one is that international student does not "speak" with other students. The other perception is that the local student does not want to mix and interact with international students. It was observed and reported by the students that there were communication problems among students with different cultural backgrounds. As coordinators mainly do not force the students in a group against his/her will. It was the mainly student select their own group. So he or she was trying to make a group with his own country fellow student or student sharing similar culture. Examples were for instance the Chinese students were trying to remain in a group. South Asian tried to make a group among themselves while East European students also had their own groups. While same was the case of local students. Local Danish student mainly interacted with themselves and very rarely make groups with the international students. They reported different reasons for not making groups with international students. One of the big reasons, other than the cultural differences, they feel that the international students 'Lack' the experience of working in groups. As a result, they can spoil the group work. They have to work a lot to teach international students about how to work in project groups, so they will not be able to focus on the main project objectives.

7. Conclusion

Culture has a significant influence on the collaborative activities during the group work in an intercultural environment. It is challenging (time management, group dynamics) to learn in intercultural student groups but it is also rewarding (in terms of intercultural learning, employability). These challenges and rewards must be taken into consideration when designing activities for international students and forming the intercultural student groups. It was concluded that the nature of the problem faced by

student groups (either intercultural or homogeneous groups) are similar to some extent like coordination of tasks, negotiations, deadlines, time and conflict management, decision making, agreement on group rules in both home student groups and intercultural groups but intercultural differences were adding extra layer of complexity to these issues. There is need to understand this layer of complexity. This paper also contributes to the discussion on cultural issues in group work at international universities.

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