Negotiation Games: Acquiring Skills by Playing

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Abstract: This paper shows the research done at the School of Industrial Engineers (ETSII) of the Technical University of Madrid (UPM), in two consecutive academic courses. In this negotiation game each team is formed by three students playing different roles, with a different degree of complexity. The game is played three different times changing the conditions and doing the Zones of Possible Agreement (ZOPA) smaller so the negotiation is going "harder" and it was more difficult for the team to achieve an agreement. Roles were distributed according to the student's experience, since it was understood that difficulty of the roles was different, especially when there was set a time limit for negotiation. The combination of playing and training has shown that students without particularly good negotiating skills at the beginning of the experiment attained better final results than those who have natural negotiating skills, but no benefit of training.

Negotiation on engineering education

Negotiation is a very important fact in whole life activities, but it became a key facet of engineering work and projects. Negotiations take continually place at any stage of a project, and so, the ability of engineers and managers to effectively carry a negotiation is crucial for the success or failure of projects and businesses [Dzeng et al., 2004; Ren et al., 2002; Murtoaro et al., 2007; Yaoyuenyong et al., 2005]. Negotiation is defined as a joint decision-making process of two or more parties working together to reach a mutually acceptable agreement over one or more issues. It involves communication, direct or tacit, formal or informal, between individuals who are motivated to converge to that agreement for mutual benefit [Yaoyuenyong et al., 2005].

Although it is important for both parts to reach an accord, many times there is not the willing to cooperate or exchange information, because they fear that the counterpart could take opportunistic advantage of the information they transmit [Raiffa et al., 2002]. Negotiating partners need then to balance **cooperative** actions with **competitive** ones, what is usually referred to as the negotiator's dilemma [Hindriks et al., 2007; Fujita et al., 2008].

The analytic approach of negotiation fact [Murtoaro et al., 2007] is based on three major fields of study, all of them related to the ideal of rational decision making: **game theory, decision analysis and behavioral decision theory**.

Quality, schedule or other facts are subjected to be negotiated, individually or as a part or a group, on engineering transactions, but from all of them, price and delivery time used to be the most important one in the majority of the negotiations, specially in construction projects [Fujita et al., 2008; Pacios et al., 2011]. When the highest price that the buyer is disposed to pay is greater than the lowest price the seller can accept, the agreement is possible. The range between these two prices is called ZOPA (Zone of Possible Agreement) [Yaoyuenyong et al., 2005].

Other concept generally utilized at negotiation is the BATNA (Best Alternative To a Negotiated Agreement) [Murtoaro et al., 2007], that can be used as an effective way to establish the reservation price [Fisher et al., 1991]. The fact of establishing a realistic reservation price based on BATNA before a negotiation take place, not only can it increase the possibility of a successful deal, but also improve one's confidence and bargaining power on the negotiation table. BATNA is even more useful when several issues are included in the negotiation, since different ZOPAs would exist and the negotiation process will become more complex.

Although negotiation skills are extremely important for engineers, it usually receives little attention on career's programs, as it is generally accepted that this kind of skills can be only learned through experience and observation [Hindriks et al., 2009; Smith, 1992; Brzostowski et al., 2006]. Negotiation knowledge is not likely to be taught only at conventional classroom with expositive methodology, as the students usually find it boring and without motivation enough to participate actively [Yaoyuenyong et al., 2005; Jiau et al., 2009]. Recent educational programs include the acquisition of competences in coordination with the acquisition of scientific knowledge.

Learning negotiations skills by playing. Methodology

The role play method is generally recognized as more suitable to increase the trainees' skills [Hindriks et al., 2009]. At this technique, the students are asked to play with some others assuming a role in an adapted engineering negotiation. They are given some common information about the scenario, the issues to be resolved or optimized (i.e. the price of a material), and some confidential information that it is not known by the others (their company negotiation position, ...). Accepting that role playing is the best choice to improve negotiation skills, there is the need to test if the joint of this kind of games with a quick theoretical knowledge on the principles of negotiation (ZOPA's principles,

negotiation positions, kinds of negotiators, BATNA, etc.) would significantly improve the trainees' results.

The main objective of the authors is to evaluate the adequacy of mixing playing sessions and theory to maximize the students' negotiation skills. This is done thanks to a research carried out with students at the ETS of Industrial Engineers of the Technical University of Madrid (UPM).

To measure the natural skill's improvement the students undergo when playing several times with a negotiation game, both with and without previous theoretical learning a pre-defined scoring system is used, combined with the time the negotiators spent to reach to the agreement.

The results will serve to introduce a short package of negotiation knowledge at post-grade engineering studies, as in the new educational programs some competences in Project Management are demanded.

Role play planning

Eleven teams were involved in the role play. Six teams will form the Experimental Group (EG) and five will be used as Control Group (CG). Both groups were asked to participate three times in a negotiation role play related to the construction project presented. After the first play, the EG received a theoretical class (F) about principles of negotiation. The objective of this theoretical class was to proof if during the next games those students have developed better negotiation skills and were able to obtain better results during the negotiation.

At the end of each game a survey was filled by each student with questions regarding the results of the negotiation, perception of the difficulty to reach the agreement, perception on the negotiators and general satisfaction with the agreement.

During the introduction of the course the frame of the negotiation was explained and the skills and qualities that a good negotiator needs. Several aspects were remarked:

a) The need to prepare properly. The difference between an interest and a position and why it's important to separate them is highlighted.
b) Different roles played during the negotiation were explained.
c) The strategy must be created and will cover the entire negotiation.
d) A tactic, on the other hand, is a very important component within that strategy. Different negotiation tactics were presented during the course.
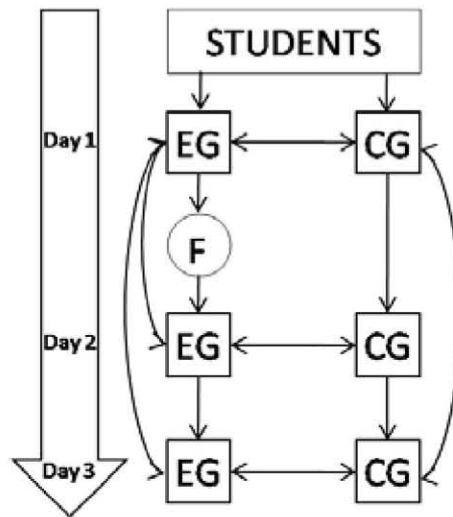
Figure 3. Methodology used to evaluate the improvement of both experimental group and control group

Role play sceneries

In this negotiation game each team is formed by three participants playing different roles (Agent A, B and C), with a different degree of complexity. The game is played three different times changing the conditions and doing the ZOPA smaller so the negotiation is going "harder". Each scenario created had a smaller ZOPA so it was more difficult for the team to achieve an agreement. Table 1 shows the data information of the different scenarios for negotiation per day.

Table 1. Role play negotiation scenery. Offer for a bridge construction that needs the participation of two subcontractors

		DAY 1	DAY 2	DAY 3
AGENT A construction company project manager.	Bid price limit	250.000 € total 100.000 € fixed cost	240.000 € total 100.000 € fixed cost	250.000 € total 100.000 € fixed cost
	Delivery time	65 days	61 days	58 days
	Bonus for objectives	Reduction on delivery time, offer increases 600 €/day Agent will increase the bonus 20% of offer increment	Reduction on delivery time, offer increases 550 €/day Agent will increase the bonus 20% of offer increment	Reduction on delivery time, offer increases 500 €/day Agent will increase the bonus 20% of offer increment
	Constraints	Restrictions on storing cast girders 10 days for girder assembly		
AGENT B production manager of a company that manufactures steel girders	Job order	100 IPN 1000 girders		
	Offer price	5 girders/day 700 € 2 extra/day and weekends 770 € Subcontracted girder 1.800 €	5 girders/day 700 € 2 extra/day and Saturdays 770 € Subcontracted girder 1.600 €	5 girders/day 700 € 2 extra/day and Saturdays 770 € Subcontracted girder 1.200 €
	Bonus for objectives	Agent will increase the bonus 10% of offer increment		
	Constraints	Storage of casted girders		
AGENT C production manager of a ready-mix company	Job order	1.000 m³ of concrete		
	Offer price	150 m³/day 40 € 250 m³/day 55 €	135 m³/day 40 € 250 m³/day 60 €	125 m³/day 40 € 250 m³/day 60 €
	Bonus for objectives	Agent will increase the bonus 5% of offer increment		
	Constraints	Product with only 1:30 hour delivery time		

It can be observed in Figure 2 how the ZOPA has changed through the different scenarios. In the figures the variations per day in the production cost is shown. As it was planned

Agent C has an easier price-time range, being day 2 and 3 very similar. Agent B risk of being the responsible of not closing an agreement is higher day 1 than day 3 (the slope of the production cost line is higher so a mistake in day of delivery will make difficult for the other agents to get an offer). Day 3 is the hardest scenario for Agent A to close negotiation since it has a range of only a few days.
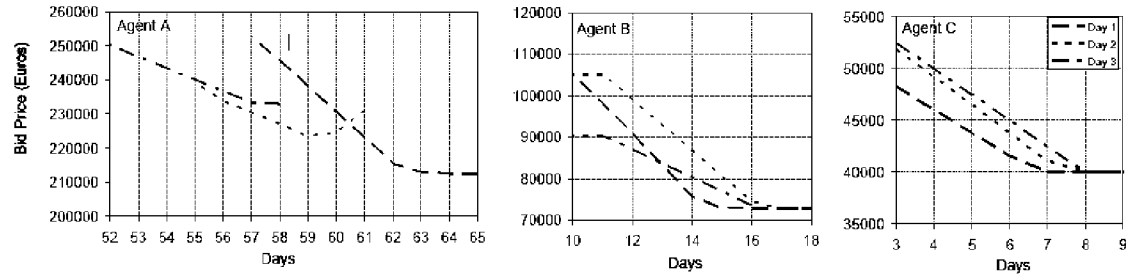

Figure 2. ZOPA for each agent at scenario 1, 2 and 3

Results and discussion

Results of the bid price and delivery time

Even though at least four iterations were needed to reach an agreement, only final results will be presented. The single observation of the data shows that if one individual agent has a profit higher than 50%, the agreement will not be valid. There is a change from day 1 to day 3 where individual profit is more controlled. Even though neither day 1, 2 or 3 the totality of teams were able to reach a valid agreement, approaches are better day by day. The first day 3 groups were not able to reach an agreement; the third day two groups were not able to reach agreement. Small mistakes were made on day 3 for not considering the dates properly.

In order to better observe the general results, Figure 4 plots the individuals bid values. In the plots upper limit represents the best agreement while lower limit represents worst agreement per agent. A clear evolution, between day 1 and 3 can be observed since bids prices are closer to average and in between best and average agreement.
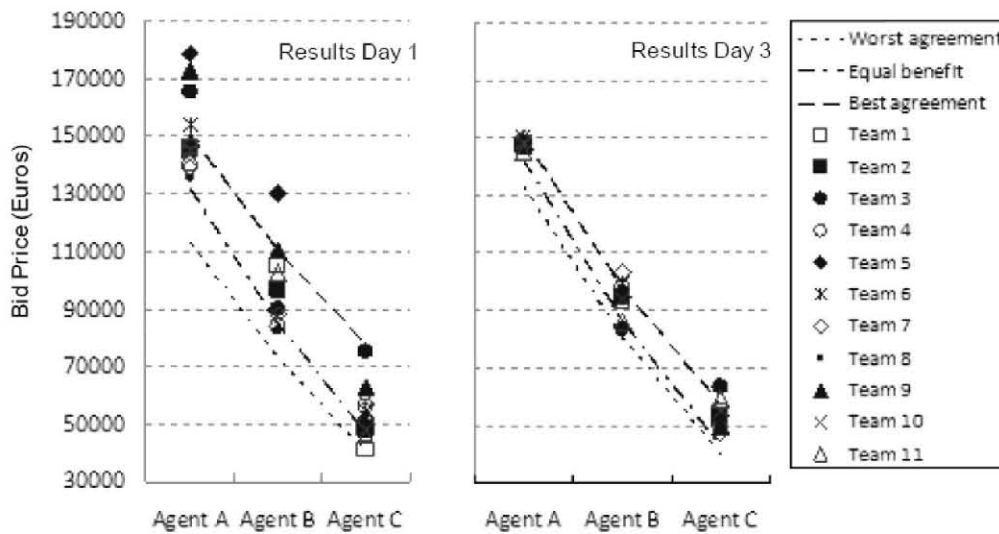
Figure 4. Negotiation bid prices

Figure 5 shows the profit distribution. It can be first observed that day 1 all agents have a high variability of benefit what makes a direct relationship with the difficulty to close a fair negotiation. Day 3 agent A for all teams has a very close benefit and agents B and C make a profit between 4% and 16%. Since in the plots all results are represented together there is nor indication of teams that have received theoretic formation and those within. All together there is indication that the experience gained by playing will improve negotiation skills.

Teams results that were not able to reach a valid agreement are not plotted in Figure 6. Evolution from day 2 to day 3 in the number of teams that were able to close a good negotiation is better for the teams with theoretical knowledge. It is important to point out that the teams selected for receiving the classes were those ones with no so good results the first day, so the teams with poor previous skills for negotiation. However final results are very similar or even better.
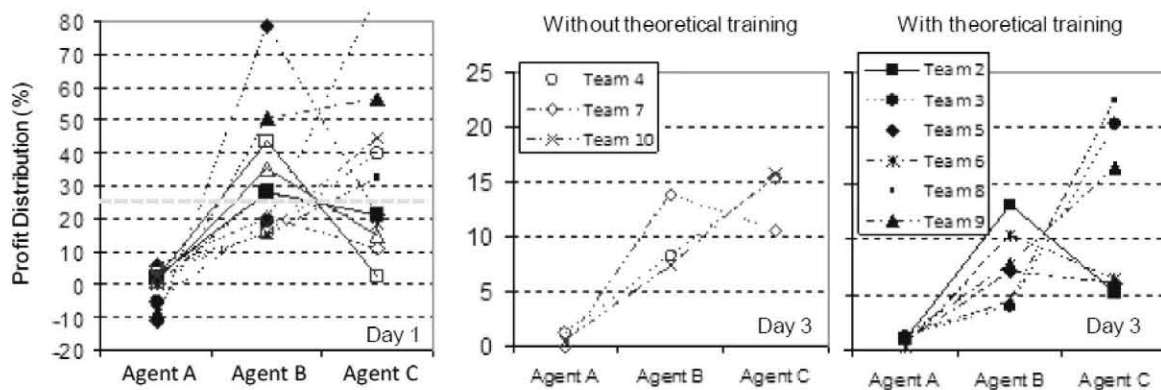

Figure 5. Effect of theoretical knowledge on negotiation results

It can be observed that the evolution by experience is to get a more homogeneous benefit distribution. Students playing the role of Agent A learned their difficulty was in setting the time delivery and that they did not have much range for playing, so they have to get the better agreement for agent B and C; that's why their profit is slighter higher over 0%. Students playing the role of agent B also were able to get a more homogeneous distribution and what is more important is the evolution of those with the theoretical formation. Students playing the role C are the ones that day 3 played harder since they were able to get the higher individual profit.

Results from the survey on negotiation skills

Generally all students perceive smaller difficulty day 3 than day 1, even though scenario for day 1 was easier. It can as well be observed that students that have received some formation sense a smaller difficulty degree.

Students perceive a greater difficulty setting the bid price than delivery time, although both parameters are related, how can be checked in Figure 2. Students that have not received any theoretical training feel the same difficulty to fix the bid price day 3 than day 1; however students with theoretical training feel a perception of the difficulty lower. Teams with theoretical training not only sense a minor degree of difficulty but get better alternatives in bid prices.

After day 2 and 3, students were asked to answer a survey related to competences development through the game. Figure 6 show the results on the students' perception over the competence strengthen. The rectangular part of the plot extends from the lower quartile to the upper quartile, covering the centre half of each sample. The centre lines within each box show the location of the sample medians. The plus signs indicate the location of the sample means. The whiskers extend from the box to the minimum and maximum values in each sample, except for any outside or far outside points, which will be plotted separately.
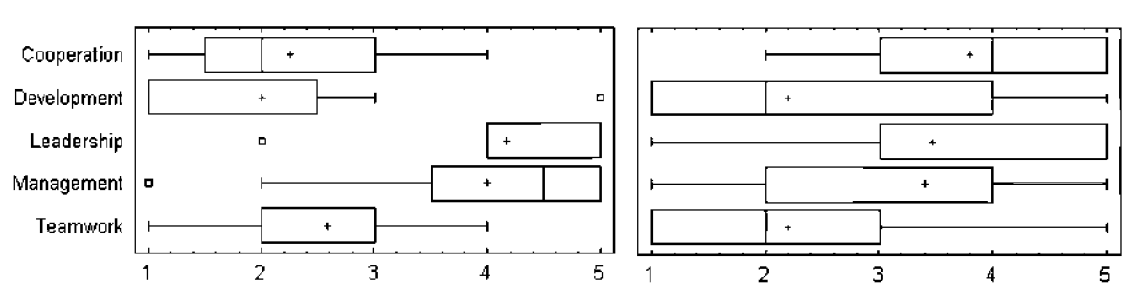

Figure 6. Competences development: Left, without training; Right with training

Students without training perceive "leadership" and "management" the competences strengthened by the game. However students with theoretical training consider also "cooperation" as one of the competences with highest result.

Conclusions and future developments

In addition to detailed technical knowledge and performance skills in engineering education, other personal and contextual skills (like negotiation) are important for these students and requires engagement, communication, creativity, understanding, conflict resolution and decision making. The opportunity to develop these skills often is unavailable to students until they become employed. Introducing students to such experiences earlier can foster the development of these abilities.

This experience has demonstrated that learning by playing is an effective way to make student learning in the subject area of negotiation and it can be an important tool for improving engineering student performance as well as motivating and enhancing other no technical abilities. The combination of playing and training has verified that the students with no special good negotiation skills at the beginning of the experiment have even reached better final results that those ones with natural negotiation skills.

The perception of both the students and teachers is that the learning approach tested was valuable and more productive than only lecture-oriented approaches, despite the fact that it required greater effort than the classical method. This experience would be adapted to other courses by changing the specific area like complaints and suppliers management. Our immediate plan is to complete the experiment by developing more personal and contextual skills for engineers: leadership, results-oriented and ethics among others. Also, scalability characteristics will be analysed by running the approach with nearly two hundred students.

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Acknowledgments

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