

Using collaborative learning techniques with students of Mechanical Engineering degree

Y. Álvarez, C. Casqueiro⁽¹⁾, R. Maceiras, A. Suárez-García

⁽¹⁾ Defense University Center at Spanish Naval Academy (Marin, Spain).
ccasqueiro@ cud.uvigo.es

Abstract

This work analyses the obtained results using collaborative learning techniques, with higher education students in the Defense University Center at the Spanish Naval Academy, in a course of Mechanical Engineering degree.

The subject Introduction to Business were the scene chosen, and the activity selected was a Jigsaw. The work included the activity design, the generation of satisfaction survey for the students and an evaluation exam.

From the obtained results in the survey, it can be concluded that the students are satisfied with the employed technique to work in this subject. Furthermore, the results of the exam show a good level of knowledge, that were better than the obtained results in the previous year using conventional learning techniques.

Introducción

The object of this work is the analysis of the obtained results using collaborative learning techniques with higher education students. The experience was developed in the Defense University Center at the Spanish Naval Academy. These students follow a course of Mechanical Engineering degree and the research was carried out in the Introduction to Business Management subject (1st course). Techniques for improving the learning were implemented for increasing the acquisition of skills, in application of European Higher Education Area (EHEA).

Old and traditional methods have focused the learning process in the teacher who shows a series of concepts to the students. The role of student becomes passive: he only takes notes and occasionally regurgitates the information [1]. The result is a little incentivized student with low participation in the learning process. In this way, the meaningful learning is improvable.

Alternatively, new techniques of learning must be developed and used to increase the motivation and participation of the student in the learning process. Active learning techniques as WebQuest or Jigsaw have become available in the last few years are showing important advantages [2] and good results [3, 4]. For this work, the chosen collaborative technique was the Jigsaw, originally developed by Elliot Aronson [5] and adapted by others authors [6]. Its principal characteristics are the following:

- Cooperative learning. The students are grouped to complete the tasks. The work is divided in partial tasks and any student must help each other to success.
- High order thinking. The creative and analytic processing of information is needed. The students have to process the information presented in the specified resources. Hence, they must do written and oral presentations with the required tasks.
- Learning autonomy. The students have an active role in the learning process and the teacher a passive one. The teacher only evaluates the student work using the rubric.

2. Experimental

The present work includes the Jigsaw design, the generation of satisfaction survey for the students and an evaluation examination. The analysis of survey and exam results is included. The Jigsaw lasted two hours. The topic object of work was "Types of Company". The participation promoted positive interdependence between the students.

For the beginning of this activity, an explanation was made to the students about the way of working in a Jigsaw activity: the Jigsaw rules were explained. After this, the teacher has made a little explanation about the topic to work. The reason is to generate in the students the curiosity for motivating them.

The Jigsaw can be developed in slightly different ways. In this case, the Jigsaw groups had three students. The topic was divided, in this case, in three subtopics with similar size and each subtopic was assigned to one student: the subtopic expert. At the same time, in the classroom, all groups worked about the same topic with the same subtopic division.

Experts in the same subtopic were grouped in the so called Expert groups. At first, each student worked independently for 10 minutes in the assigned subtopic. Next, the Experts leaved their Jigsaw group and met other Experts in identical subtopic for discussing for 20 minutes. After that, each student came back to its Jigsaw group for teaching their subtopic to the other members. This way, all members of each Jigsaw group acquired the knowledge of complete topic because they work in the own subtopic and assist to the explanation of the others subtopics by their group colleagues.

At last, one member of each group showed to the teacher part of the acquired concepts. The assessed member was random selected because the time was limited and only one presentation by group was possible. The representative member of each group was selected at the end of the work time. In this manner, all students had to prepare their speech. The chosen student explained one of subtopics that he didn't work as an expert.

After the activity, students answered an anonymous survey about their experience's satisfaction. The survey was about their opinion about some characteristics of the activity. The survey questions employed in this work were:

- Does the student like work in groups?
- Does the student like make this type of work again?
- Does the student believe that this activity improves the learning?
- Does the student believe that this activity improves his interest in the subject?
- Does the student believe that this activity improves his communication with classmates?
- Does the student believe that this activity improves his transversal competences?

The survey was answer by all students of the group: 42 students who studied the subject. The opinions were rated for the students with a Likert scale between 1 and 5, when 1 is "totally disagree" and 5 corresponds to "totally agree".

To enhance the knowledge of the result of using the Jigsaw with any objective evidence, students took an exam for evaluating their knowledge about the topic. The exam results could be compared to the older results of similar exams in other years, by analysing a few statistical parameters like mean and standard deviation

3. Results and Discussion

Image 1 shows the results referred to the student perception about the activity. It is possible to say that the activity was found interesting among most students: more than the 78% indicate than this activity improved their learning, and the 80% agreed in repeating the Jigsaw with another topic. Only the 10% believes than this activity does not increase their interest in the subject.

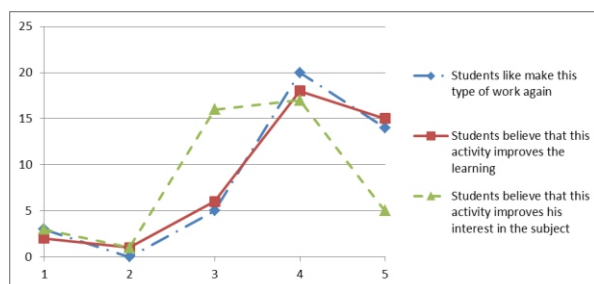


Figure 1. Perception about the activity.

About working in groups, 85% of students partially or totally agreed. Image 2 shows the results about this question. It is necessary to highlight that the work was assigned for the teacher to each member of the group. The group did not have decision about the partition of the topic into subtopics or the way of share the tasks. At first, each student interacts only with the other Expert in the same subtopic, and next he must to explain to the others members of his group. But really, the success in his task has a limited dependence of the work of his colleagues.

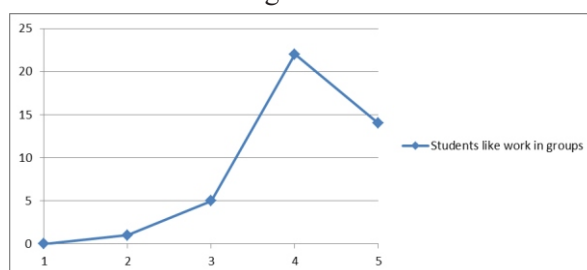


Figure 2. Opinion about working in groups.

In concerned with the utility for improving the transversal competences like the communication skill, the opinions are not so favourable. Only the 12 % disagrees, but an important percentage is not for or against. No results about the reason of this opinion are available, and can be a next field or analysis.

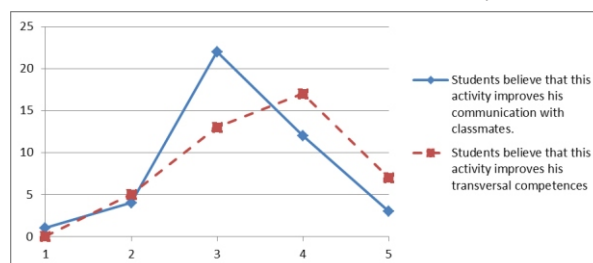


Figure 3. Opinion about working in groups.

In relation of learning outcomes, the results of corresponding part of exam of last year and present year was compared. Image 4 shows the distribution of scores in the two last years. In the 2013-14 the Jigsaw was employed and in the previous year only traditional methods were used for teaching. In 2013-14, the average score of the Jigsaw object topic obtained in the exam was 6.4 (SD 1.9) over 10. In the previous course, the same topic was taught in the traditional way as lectures and the average qualification was 5.7 (SD 3.2) over 10. These results show an appreciable improving when collaborative learning is used. It is necessary to point out that in both cases the time of classroom was the same.

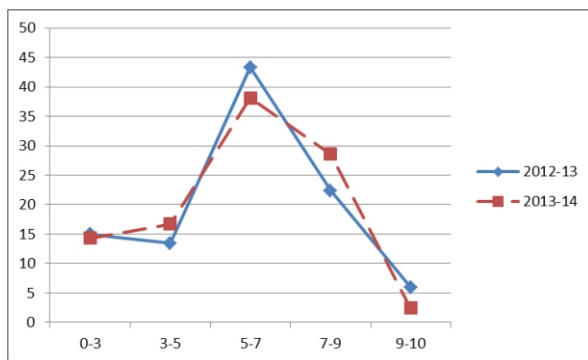


Figure 4. Comparative of distribution of scores from the exam.

4. Conclusions

This paper evaluated the use of collaborative learning in an engineering course. The scores of the final exam were compared with the obtained results in the previous course where collaborative learning have not been used. From the obtained results in the survey, it can be concluded that the students are satisfied with the employed technique to work in this subject. Moreover, the results of the exam show a good level of knowledge, that were better than the obtained results in the previous year using conventional learning techniques.

5. References

- [1] Michael, J. Where's the evidence that active learning works? *Advances in Physiology Education* 30 (2006) pp. 159–167
- [2] Hassanien, A. Using Webquest to Support Learning with Technology in Higher Education. *Journal of Hospitality, Leisure, Sport and Tourism Education*. DOI:10.3794/johlste.51.96. (2006).
- [3] Baelo, S. (2010). Blended Learning and the European Higher Education Area: The Use of WebQuests. *Porta Linguarum* 13, pp. 43–53
- [4] Gülbahar, Y., Madran, R. O., & Kalelioglu, F. (2010). Development and Evaluation of an Interactive WebQuest Environment: “Web Macerasi”. *Educational Technology & Society*, 13 (3), pp. 139–150
- [5] E. Aronson, N. Blaney, C. Stephin, J. Sikes, M. And M. Snapp. “The jigsaw classroom”. Beverly Hills, CA: Sage Publishing Company, 1978.
- [6] M. Seetharaman, and K. Musier-Forsyth. *Journal of Chemical Education*, 80 (12), 1(2003) p. 404.