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Directed Approach and Resolution of Practical Cases as a Motivation Tool for Self-Learning and Cooperation

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***Abstract*—**The development of competences and practical capacities of students is getting an important incidence into the guidelines of the European Higher Education Area (EHEA). The methodology applied in this work is based on the education through directed resolution of practical cases. All cases are related to professional tasks that the students will have to develop in their future career. The method is intended to form the necessary competences of students of the Marine Engineering and Maritime Transport Degree in the matter of "Physics".

The experience was applied in the course of 2011/2012. Students were grouped, and a practical task was assigned to them, that should be developed and solved within the team. The aim was to realize students learning by three ways: their own knowledge, the contribution of their teammates and the teacher's direction. The results of the evaluation were compared with those obtained previously by the traditional teaching method.

***Keywords*—**Cooperation, Marine Engineering, Self-learning skills.

I. Introduction

LEARNING by experience is a methodology based on the following proven course: "teaching is more effective when it comes from the need and practice". Namely, we learn more easily, when we need to do it. [1]

Formation by self-learning not only transmits knowledge, but also makes the students learn, how to learn. It provides adequate self-training techniques that enable learning very complete, robust and effective.

"Cooperative learning is a specific type of collaboration" [2], or a definite form of educational activity promoted from teaching. For Johnson, Johnson & Holubec, "cooperative learning is the instructional use of small groups in which students work together to maximize their own learning and that of others" [3]. As such, cooperative learning involves pedagogical representation on peer interaction [4].

During development of the cooperation activities the students are the ones, who study, analyse and find solutions to the problem, while the teacher directs and oversees the development of their learning. One purpose of this method is to foster personal relationships between classmates, encouraging students to be able to work together with any partner. It also achieves that students become independent in their learning process. Moreover, they are developing the ability to select the available information for giving the most appropriate answers to the questions and empathize with their band mates to get consensus.

Both, self-learning methods as well as cooperative learning, are powerful tools for teaching small groups of students. These kinds of methods are very present in the guidelines of the European Higher Education Area (EHEA) [5]-[7].

This paper presents the evolution of the students during the development of self-learning activities and cooperative learning in the field of "Physics". That subject is taught in the first year of the Degree in Nautical Engineering and Maritime Transport. The main difficulty observed in the previous courses during development of the subject program lies in the diverse previous knowledge of the students, who come to classes in the first year of this degree. About 50% of students come from training courses related to the field-sea fishing, where physical or mathematical concepts are not developed deeply enough to tackle these subjects without difficulty. In addition, a small proportion of students are coming from the working environment. Students from this sector bring extensive expertise but also present problems when developing more basic and theoretic physical or mathematical concepts. This prevents the class from keeping a proper overall progress. This drawback is hardly surpassed in the traditional teaching method, in which the keynote address is the fundamental tool of knowledge transfer. The low teacher-student interaction, and even among students, which generates the traditional system of education, causes a delay in learning of students in this section for the benefit of students coming from studies, in which the prior acquisition of knowledge is more adequate.

A. Goals

The general objectives that have been followed with the planning and development of this experience are:

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a) Integrate and relate the theoretical knowledge acquired during teaching sessions to the application to practical situations specific for the nautical sector.
b) Optimizing academic performance of students.
c) Assist to the students in the development of their skills, both general and cross-cutting, as it is indicated by the EHEA.
d) Promote both, self-learning and cooperative learning, so that students from less suitable curriculum are able to achieve the required level for the subject with the help of the teacher and their teammates.
e) Maintaining a responsible attitude and cooperation among students.

Once the experience ended, the expected specific objectives are:

a) The students must know and apply correctly the theoretical concepts acquired during the development of the subject.
b) They all must have obtained equivalent levels of knowledge, regardless of prior educational level, at which they started. Thus all the courses students can tackle the second course on equal terms.

The ultimate goal of this study was to conduct an analysis of academic results obtained after having developed self-learning program and cooperation, linking them with the previous level of knowledge of students. Furthermore, these results are compared with those obtained in previous years, in which the method was the traditional teaching.

II. Methodology Used

A. Planning and Development Experience

The experience was applied in the first quarter of the year 2011/2012, during the development of the subject of Physics in the first year in Nautical and Maritime Transport Engineering Degree.

With the introduction of new degrees in the EHEA, the development of the course passes through two distinct class types: lectures and interactives. During those interactive classes, the teacher presents the knowledge to the student by a masterly lecture. The mathematical proofs of different physical theorems are very complex to understand for students, in consequence, their attention is lost and the attendance to the class is greatly reduced. To mitigate this effect, it was chosen to stop repeatedly the lecture and to propose and solve practical cases that are similar to those students will have to develop in their professional career. Even some video projections are projected in this time. The aim of this procedure is to capture the students attention and to break the routine of the session master, reducing its negative effects on students achievements.

The development of cooperative and self-learning work takes place mainly during interactive classes, in which the number of students is small [8] Different learning tasks tailored to the capabilities of the students can be developed in groups. These groups consist of students from with diverse levels of knowledge. The objective pursued by this practice is to create an autonomous group, in which a diversity of approaches lead to the resolution of the question. Students with deficiencies may acquire the knowledge they need to pass the subject not only by their teacher, but also by working with their teammates. Also, students who come from the labour sector can provide expertise to other team members.

During the first lesson of the course, the dynamic of work will be explained to the students. Moreover, they are asked to respond to academic issues such as their education level, the academic program they chose, the time that has elapsed since they left school, their work experience, etc.. An initial level test is made too and the information gathered is used by the teacher to make a first grouping. The scheme of work is dynamic, so that students can move from one group to another in order to optimize their progress and even to improve social relations in the set.

Once the groups are defined, each of them is assigned a case study that will be developed and resolved within the group. This is done for each block of the course. In each case it is proposed to solve a problem related to the marine industry. To reach to the solution of the problem, the student will have to use one or more of the physical concepts learned earlier in the session dedicated to the corresponding part of the program.

The student is provided with some references, videos, PowerPoint presentations, etc. for the resolution of the task after the preceding explanation made by the teacher during the expositive lesson. All media of support are related to the issue that will be addressed in each case. The access to the information is provided through computer communication technologies available at the University of A Coruña, such as the learning platform Moodle. This method combines the traditional explanation with new technologies. It makes the information much more accessible and streamlines the workflow. The final goal is to make the students learn by three ways: their own knowledge, the contribution of their peers and the teacher's direction.

At the end of the process, each group should explain on the board to the rest of the groups the way used to reach the solution of the task. In this way, all students have access to the approach to resolve all proposed practical cases. Finally, the teacher will generate a discussion, in which students analyse the results obtained by their classmates.

A bulletin with a compendium of practical cases similar to the previously studied is given to the students. It’s the same for all of the students. Each student has to solve it and to submit it to the teacher for evaluation. The complete schedule of activities is shown in Table I.

With the case study cooperative learning and assimilation of theoretical concepts is achieved through their application. This part of the process allows the teacher to assess the student's ability to work together and keep track of the progress of the students throughout the course. Students learn during the execution of the exercise and subsequent discussion. With the bulletin the professor can assess the evolution of each

student´s learning in an individual way, and therefore, analyse the influence of the previous level of the student on his ability to successfully develop the course [9]-[11].

TABLE I
ACTIVITIES SCHEDULE

ACTIVITY	PERSONNEL	TIME
Description of the subject Presentation of information sources and the available communication technologies Description and guidelines of the cooperative learning method Level test	Professor	First lesson (one hour)
Presentation of theoretical concepts by using necessary technologies Distribution of working groups with relocation if necessary Assignation of the practical case to each group	Professor	Theory session (one hour)
Development of the practical case Exhibition of results obtained Discussion of results	Students	Interactive session (one hour)
Distribution and development of single newsletter Tutoring with the teacher about the work to be performed	Professor Students	One week

B. Evaluation Method

The experience was analysed using two methods of evaluation:

1) Teacher's assessment: the responsible professor evaluates the progress of students both in the group as well as individually. The monitoring of the group work is

TABLE II
PROFESSOR'S EVALUATION CRITERIA

	EVALUATION CRITERIA
Group work	• Level of resolution of the practical case • Ability to summarize the knowledge • Scientific and technical quality of the presentation • Quality of references and sources of information used • Ability to work in a group • Value of the conclusions reached
Individual work	• Level of resolution of the case

The individual work is evaluated based on the results reached in the individual bulletin.

2) Evaluation by students: At the end of the experience a questionnaire is passed to each student. They have to answer a series of questions to give their opinion about the effectiveness of the method. The questionnaire is given in Table III.

This method allows evaluating the experience of the activity carried out. It is used to get two key indicators: academic results at the end of the course and the results of the satisfaction survey made by the students. The latter leads the teacher to improve those aspects that have bad grades from the point of view of the students [12], [13].

TABLE III
SURVEY OF STUDENT ASSESSMENT

1. Disagree / 5.Agree	1	2	3	4	5
1. The materials posted on moodle helped me to learn					
2. The resolution of case studies has helped me to understand the subject					
3. It is necessary to get the contents of the course updated					
4. I lost more time in learning the same concepts with this method					
5. I believe that this evaluation method is better than the traditional					
6. Group work is a positive experience					
7. Pooling the case study has helped me to understand the subject					
8. The interactive class in small groups usually helps me with matter					
9. Direct contact with the teacher in the classroom is a positive experience					
10. Only students who have not studied physics in the last two years: Group work helps me to understand the previous concepts without limitations					
Comments:					

The overall evaluation of the course is conducted according to the government agreement approved on October 23, 2008, on the new degree courses, which requires the implementation of activities and continuous assessment tests. These evaluation criteria are clearly presented to students during the first master session and can be consulted in the teaching guide at any time during the course. Qualifications obtained by students during the development of the cooperative experience and the individual work account for 30% of the final qualification of the course. The remaining 70% come from the result obtained in an objective test held late in the semester. In the final test, the students must solve proposed problems similar to those

previously raised in interactive class where the students will need to apply concepts that encompass the entire program of the subject.

III. Results

Below are the results obtained during the development of the experience in the first semester of 2011/2012.

Fig. 1 shows the results of the satisfaction survey given by students at the end of the teaching of the subject.

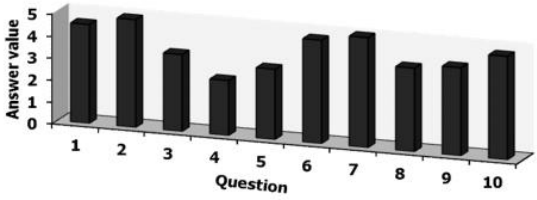

Fig. 1 Results of the satisfaction survey

The results show that students consider the method based on cooperative working as efficient. The information provided in the moodle platform is considered as sufficient and students appreciate the direct contact with the teacher and with their classmates. However, the investment of time is considered excessive to perform the proposed tasks. However, the acquisition of knowledge with this method is regarded faster and easier than in the traditional method.

Fig. 2 shows the results obtained during the academic year 2011/2012, in which has been applied the experience described in this paper, after the completion of the final test.

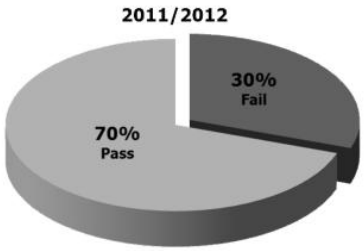

Fig. 2 Academic results obtained after the development of the experience

The weighted grades are presented, including the assessment of cooperative work, individual exercises and the final test.

The academic results are quite satisfactory, considering that 70% of students who had followed the experience, were successful. This indicates that the activity is appropriate and the students are able to acquire the demanded skills.

IV. Conclusions

Due to the inclusion of the Spanish education system into the European Higher Education Area, it is becoming more necessary to emphasize different skills development of students, not only related to academic work, but also in the labour sector and the social relations. To this end, it were developed activities based on cooperative work and self-learning.

After the implementation and the evaluation of the above mentioned process, positive aspects were found in the development of the capacity of students autonomy and self-regulated learning. The teacher observed that the analysed groups performed well throughout the course and academic results are highly better.

Activity also allows resolving the problem of academic diversity of students coming to this degree. Thus, the set of students reaches a homogeneous academic level at the end of the course and they can pass to the second year at similar conditions.

References

[1] R. Carballo, *Experiencias en grupo e innovación en la docencia universitaria*, Ed. Madrid: Complutense, S. A., 2002.

[2] K. Nagata, S. Ronkowski, *Collaborative Learning: Differences between Collaborative and Cooperative Learning*. Ed. The Office of Instructional Consultation, University of California, Santa Barbara. 1998.

[3] D. W. Johnson, R. T. Johnson, E. J. Holubec, *El aprendizaje cooperativo en el aula*. Buenos Aires: Paidós, 1999.

[4] C. Suárez Guerrero, *Cooperación como condición social de aprendizaje*, Ed. Barcelona: UOC, 2010.

[5] D. W. Johnson, R. T. Johnson, K. A. Smith, *Cooperative Learning: Increasing college faculty instructional productivity, ASHE-ERIC Higher Education Report*, 4. George Washington University, 1991

[6] R. Ferreiro, *Estrategias didácticas del aprendizaje cooperativo. El constructivismo social: una nueva forma de enseñar y aprender.* Trillas-Eduforma, 2006.

[7] D. W. Johnson, R. T. Johnson, & E. J. Holubec, *Cooperation in the Classroom (6th ed.)*. Edina, MN: Interaction Book Company, 1993.

[8] E. G. Cohen, *Designing Groupwork: Strategies for heterogeneous classrooms.* New York: Teachers College Press, 1994.

[9] M. A. Zabala, *Evaluación de los aprendizajes en la Universidad, Didáctica Universitaria*. Madrid, 2001, pp. 261-291.

[10] M. González, M. Fernando, L. C. Herrero, M. A. Martín, I. Mozo, C. Quintano, *Actas de las II Jornadas Internacionales UPM sobre Innovación Educativa y Convergencia Europea, Análisis de metodologías y métodos de evaluación para el desarrollo de competencia.* Madrid, 2008.

[11] C. Mayor, *El asesoramiento pedagógico para la formación docente del profesorado universitario*, Sevilla: Secretariado de Publicaciones de la Universidad de Sevilla, 2007.

[12] I. Cano, *Experiencias de innovación docente en la Universidad de Alcalá, Reflexiones sobre el proceso de enseñanza-aprendizaje*. Alcalá de Henares: Servicio de Publicaciones de la Universidad de Alcalá de Henares, 2007, pp. 57-81.

[13] C. Hart, P. Mulhall, A. Berry, J. Loughran, R. Gunstone. *What is the Purpose of this Experiment?: Or can students learn something from doing experiments?*, Journal of Research in Science Teaching, vol. 37, no. 7, pp. 665-667, 2000.