

# ASSESSMENT BY THE STUDENTS OF ACTIVITIES TO IMPROVE THE ACQUISITION OF COMPETENCES ON THE SUBJECT ORGANIC CHEMISTRY IN THE DEGREE IN CHEMISTRY

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## Abstract

This paper presents a study of different teaching methodologies focused on improving the acquisition of competences in the subject "Organic Chemistry I" in the degree in Chemistry conducted at the Faculty of Science at the University of Burgos. The aim of this study was the use of these methodologies (daily activities, on-line questionnaires, reports, assessment tests at the end of each topic, interactive exercises and videos) to support the classroom teaching in order to facilitate the assimilation and the progressive development of contents of this subject that is regarded as difficult by the students. For the evaluation of the results after the implementation of the mentioned methodology, we have used satisfaction student surveys. In general, we have found that a very large majority of student was "very satisfied" and "satisfied" with all the activities carried out throughout the academic year.

Keywords: Continuous assessment, teaching methodologies, satisfaction surveys.

## 1 INTRODUCTION

The renovation of teaching methodologies should be focused on improving student learning. There must be promoted those methodologies that allow the achievement of the formative aims and the competences of each discipline in the frame of the undergraduate degree.

Teacher has to propose training evaluable activities to facilitate the progressive assimilation of the contents of the subject. Thus, the assessment becomes continuous and the teacher can make a greater and better monitoring of progress in the student learning.

Continuous assessment provides greater assurance of passing the subject. First, because students have gradually assimilated the most important contents of the subject; secondly, because they know how the evaluation by the teacher is; thirdly, ongoing evaluation should prepare students for exams because, for consistency, these will have the same structure as the proposed activities throughout the entire course.

The ongoing evaluation activities can be of various types depending on the subject and in which degree is included. In the field of Organic Chemistry, activities may include exercises related to the structure of organic compounds, three-dimensional representation of these compounds, synthetic methods for their preparation, mechanisms of the reactions involved, proposals synthetic routes, debates on current affairs, interpretation of related daily events ... In short, the possibilities are vast.

In our opinion, it is important that the approach of the proposed activities is aimed at the application of the theory to a practical case, or to the reflection on certain aspects, or the relationship between different contents. This approach provides, without doubt, better training for two reasons: firstly, because it contributes to the assimilation of the contents; secondly, it has the added value that the student is able to apply organic chemistry to specific situations, as it will do in his future professional career.

New information technologies have made possible the appearance in university intranets of spaces of interaction between teacher and students. In particular, the use of the Moodle platform is, without doubt, a very important educational tool to support or complement to classroom university teaching. In Moodle, students can find information, materials and teaching resources relevant to the development of the subject (such as subject programme, evaluation criteria, related news, basic or additional bibliography, links ...), send their exercises, compare and assess the degree of learning (self-assessment exercises of different types ...), participate in discussions, etc. Even the teacher can use the website of the subject to channel tutorials and consultations of the subject. Therefore, it is a complementary technological tool for the classroom.

Since the Faculty of Science at Burgos University adapted their study programmes of Chemistry to the European Higher Education Area (EHEA), we have incorporated methodologies in order to facilitate the acquisition of skills and competences in the subject of "Organic Chemistry I" (trunk, 6 credits) in second year of Chemistry Degree.

The objectives we proposed to get were:

- Facilitate the assimilation and the progressive development of contents of the subject and the competencies to be achieved
- To get a rough idea of the time spent by the student in the preparation of the subject.

For this reason, a programming of tasks aimed at the acquisition of competences has been developed:

- Perform a series of activities related to the matter dealt with in class.
- Answer a questionnaire online at the end of each topic of the subject.
- Carry out an assessment tests at the end of each topic of the subject.
- To provide the students interactive exercises to solve voluntarily at the end of each topic.
- To provide students with a series of videos and flash concerning the matter explained in each topic of the subject

This project has been implemented in several courses since 2009-2010 academic year, but in this paper we present the results obtained in 2013-2014 academic year.

The evaluation of the course also includes performing two exams of resolution of issues and problems that students should not have trouble overcoming whether they have actually performed the activities proposed during the course.

Throughout the course has been carried out the support of classroom teaching with the use of the Moodle platform. The organization of the topics in Moodle has followed a similar scheme. They show, at the beginning of each topic, the specific competences that they have to achieve, documentary sources, resources developed by the teacher, activities that they have to work in accordance with the contents explained in class, problems to solve in class, Internet audiovisual materials, interactive self-assessment exercises and questionnaires on-line.

## **2 METHODOLOGY**

In the following section we are going to present the different methodologies used in this project.

### **2.1 Daily activities**

Students have to answer some questions/exercises related to the contents presented in the teaching classroom. In this way, they have to revise and apply the most significant concepts previously explained by the teacher. These daily activities help the students to keep up with the study of the subject.

The students find in Moodle, after the teaching in the classroom, the activity that have to answer with the competences that they have to work for each activity and the date to present it. Also, we asked them to indicate the time they have needed to prepare and answered the activity. These activities represent the 21% of the final evaluation. They are also asked to indicate the time needed to prepare and respond the activity

In these activities, the professor guides the student work through a series of questions on which the students must apply the most significant concepts previously studied, to prove the acquisition of such aptitudes and skills.

These activities require that teacher to prepare a huge number of formative questions/exercises, greatly exceeding those with more conventional tools, as well as a continuous monitoring.

### **2.2 On-line Questionnaires**

In order to revise and improve the acquired knowledge, at the end of each topic, students have to answer a questionnaire on-line in Moodle. The Moodle quiz is a powerful and flexible tool for

monitoring and diagnosing if a student understands of certain types of knowledge [1]. This tool is simple to use and indicates if the training has been effective or not, allowing as well the automation of the correction process by providing the right answer to each question.

One of the advantages of Moodle quiz is that scores for quizzes automatically appear in the Gradebook.

### **2.3 Reports**

After finishing the study of a topic, students have to upload a document with a summary to the Moodle platform. In this report they also have to indicate the difficulties that have been found when they studied the topic.

### **2.4 Assessment tests at the end of each topic**

At the end of each topic, students have to do an assessment test of the contents explained in that topic. It is a way to study the subject every day and understand concepts that will be necessary apply in next topics.

### **2.5 Interactive exercises**

Students have interactive exercises in Moodle, grouped into topics, that helped them to consolidate what is being explained and allow them to acquire the skills relates to each topic. These interactive exercises intended to improve understanding of the contents and to promote the autonomous work of students.

### **2.6 Videos**

Videos help students to learn and study the subject. They can spend time at home reinforcing the concepts that need more time to be understood. On the other hand, we choose videos where the subject is explained in English, so they can practice in order to work in the acquisition of one of the transversal competences of the Chemistry degree.

## **3 RESULTS**

Although the methodology used is described in the subject guide (i.e., classes, daily activities, on-line questionnaire, exams, reports, assessment tests at the end of each topic, interactive exercises, videos,...) together with their evaluation procedure, and they can read it in Moodle, the first day, in the presentation of the subject, we explained to the students the methodology that is going to be followed throughout the course and the evaluation criteria.

For the evaluation of the results after the implementation of the methodology mentioned we have use satisfaction student surveys.

The survey consists of 4 questions concerning the usefulness of different activities. In these case students were asked to report one answer on a four category scale ("Very Satisfied", "Satisfied", "Unsatisfied", "Very Unsatisfied") and open-ended questions.

The survey used was:

- 1 How satisfied are you with...?
  - a) Daily activities
  - b) On line questionnaires
  - c) Reports
  - d) Assessment test at the end of each topic
  - e) Interactive exercises
  - f) Videos

Choose an answer on a four category scale: "Very Satisfied", "Satisfied", "Unsatisfied", "Very Unsatisfied"

- 2 What methodology have you found most interesting and why?

- 3 Was it useful the work done (activities, reports, on line questionnaires,...) for a better follow-up of the subject? Choose an answer on a four category scale: “Very Satisfied”, “Satisfied”, “Unsatisfied”, “Very Unsatisfied”.
- 4 Have you spent more than 1.8 hours of personal work per hour of classroom? Approximately, how many hours?

With respect to the degree of satisfaction with the “daily activities” showed in question 1a (see Figure 1), 78% of students were “very satisfied” and 16% “satisfied”, only 6% were “unsatisfied” and none of them were “very unsatisfied”. This was the methodology best evaluated by students.

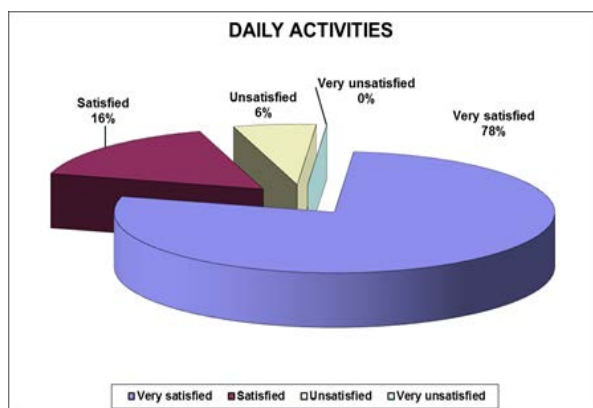


Figure 1: Answers to question 1.a

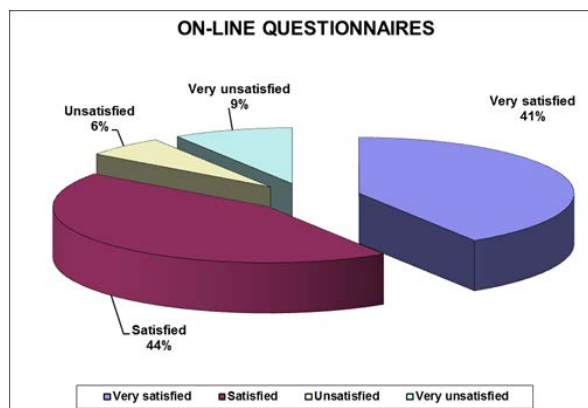


Figure 2: Answers to question 1.b

About on line questionnaires (question 1b), as seen in the Figure 2, they were considered as “very satisfied” (41%) and “satisfied” (44%) whereas 6% and 9% reported as “unsatisfied” and “very satisfied”, respectively. We can conclude that on line questionnaires pleased majority of students.

Regarding the opinion about “reports” showed in question 1c (see Figure 3), 19% of student answered they were “very satisfied” and 47% “satisfied”. In this question 22% of them were “unsatisfied” and 12% “very unsatisfied”. This activity was not as well considered and it would be reconsidered for next years.

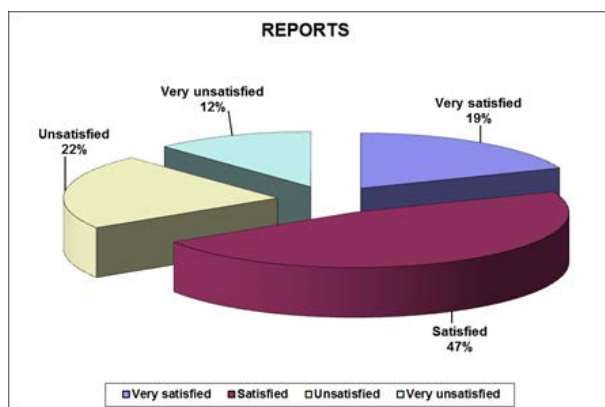


Figure 3: Answers to question 1.c

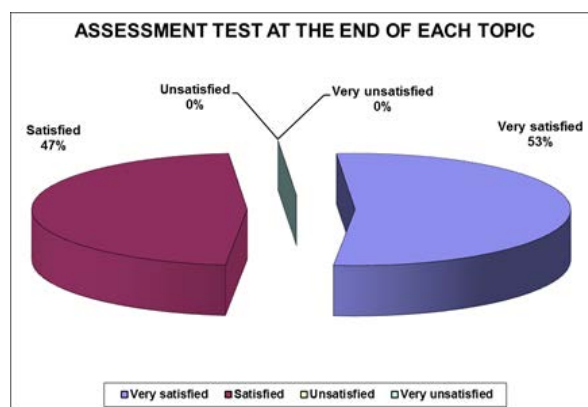


Figure 4: Answers to question 1.d

As it can be seen in Figure 4, considering the answers to the “assessment test at the end of each topic” (question 1d), it is clear that all students agreed with this activity, 53% were “very satisfied” and 47% “satisfied”. They think these assessments help them to study the subject every day and in this way it is easier to pass the exams.

These four activities considered at the moment represent the 40% of the final evaluation.

The other two activities analyzed help students to prepare the exams but were not evaluated. In particular, “interactive exercises” allow them to review the contents explained in each topic and were a complement of the exercises solved in the classroom. The analysis of the question 1e (see Figure 5),

related to “interactive exercises” show this activity was positively valued by student, 24% of them were “very satisfied” and 52% “satisfied”. On the other side, 10% of them were “unsatisfied” and 14% “very unsatisfied”.

Quite similar results were obtained in the answers to question 1f (see Figure 6) where students were asked about “videos”. In this case 25% of students answered they were “very satisfied” and 43% were “satisfied”, 14% “unsatisfied” and 18% “very unsatisfied”.

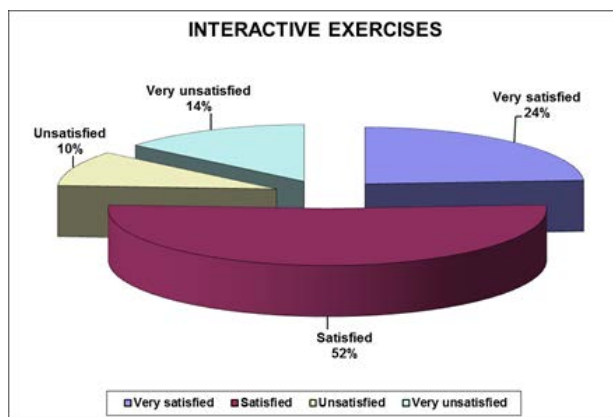


Figure 5: Answers to question 1.e

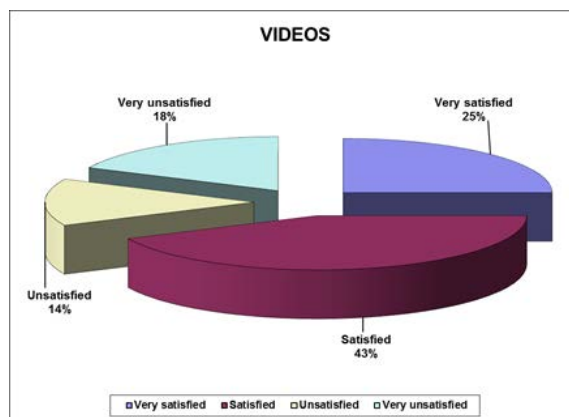


Figure 6: Answers to question 1.f

When they are asked about what methodology they have found most interesting and why (question 2), most of them agree that daily activities and questionnaires on-line are the methodologies they found most interesting. In the first case, because these daily activities help them to study the subject every day and, in the second case, because questionnaires on-line allow them to evaluate their knowledge about the topic previously studied.

With respect to answers to question 3 where they were asked if all the works performed have served for a better follow-up of the subject, as it can be seen in Figure 7, the majority of the students stated positively, with a 83% of the student “very satisfied” and 17% “satisfied”, and none of them were “unsatisfied” or “very unsatisfied”.

In general, we can conclude that a very large majority of student was “very satisfied” and “satisfied” with all the activities carried out throughout the academic year.

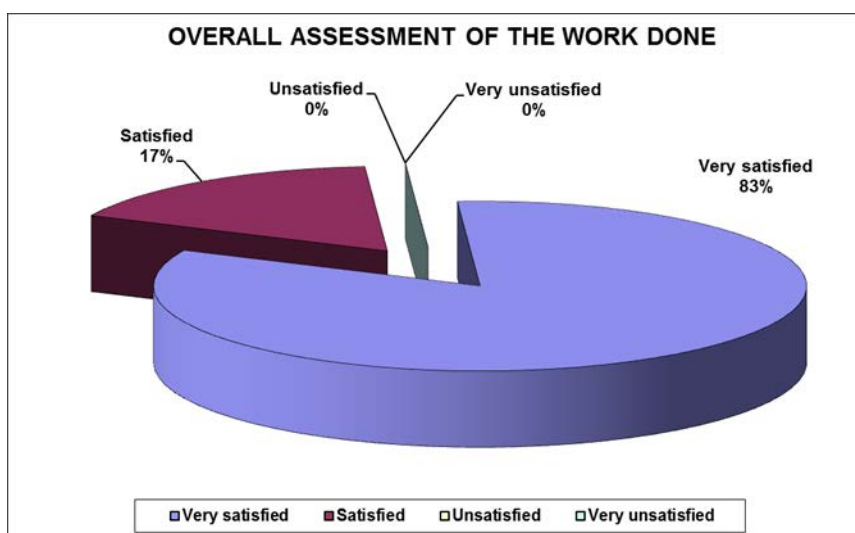


Figure 7: Answers to question 3. Overall assessment of the work done

In question 4, when students were asked about the time they have spent in the study of this subject, the results obtained in this survey did not agree with those obtained when they were asked in the

activities carried out through the course. They answered this survey before the last exam carried out in the course and they have the perception that they have spent a lot of time for the study of the subject.

#### **4 CONCLUSIONS**

In this paper we have presented the results of the study carried out with different methodologies in order to facilitate the acquisition of skills and competences in the subject of "Organic Chemistry I" in second year of Chemistry Degree. After an evaluation with satisfaction student surveys, we can conclude that this methodology helps students in their learning process. We have supported this conclusion on the fact that the overall students perception of the utility of this methodology is very high, and that they are useful tools for study and to do a better follow-up of the subject.

#### **REFERENCES**

- [1] Cole, J, and Foster, H. (2008) " Using Moodle: teaching with the popular open source course management system", 2nd Edition.