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# Chemistry course for radiochemistry engineers on the platform Moodle: a support to self-education for undergraduate students

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Open Educational Resources (OER) in a global world  
University Education

## Abstract

The education challenges at present times include the incorporation of information and communication technologies (ICT) in the learning-teaching process. In Higher Education the agreement between the volume of information to be processed by the student, the available student's time and the assimilation of the courses contents is very important. The new study plans in Cuban Universities include the reduction of the number of face to face hours and the increase of the available time for the student's independent study. Then, it is necessary to develop abilities that upgrade learning capacity during a lifetime through the self-education. The first version of a course on chemistry for radiochemistry students using the platform Moodle and Open Educational Resources (OER) as a support to the undergraduate course is presented. The detailed topic plan of the course of chemistry for radiochemists, which was distributed week by week, and different activities combining communication, interactive and collaborative modules were implemented on the platform Moodle. The whole system was tested during the first semester of the 2010-2011 academic year. The course evaluation results were carried out through a survey among the students and discussion forums. The results showed a good acceptance by the students, a better efficiency in the teaching-learning process given by better planning of the individual study, a better preparation to perform the laboratory practices, the new possibilities of communication between students and teachers, the access to OER and greater self-conscious of the students on their own process of learning.

Keywords: ICT, self-education, platform Moodle, Open Educational Resources

## 1- Introduction

The education challenges at present times include the incorporation of information and communication technologies (ICT) in the learning-teaching process. In Higher Education, the relation between the volume of information to be processed on part of the student, the available time for that and the assimilation of the contents in the courses are very important. The new study plan in the Cuban Universities (Plan D) comprises not only a reduction of face to face hours of students but also an increase of their available independent time to study.

It arises the need to develop abilities which strengthen learning during the whole life through self-education (1-2). In the developing teaching-learning process, the ICTs are classified as teaching-learning means which should agree with their contents and structure. In Cuba, since the year 2000, courses through different collaborative platforms have been carried out in Higher Education aimed mainly at the teaching of graduate courses and blended learning, derived from the universalization of learning (3). In several Cuban Universities, it is frequent the use of the platform Moodle since it is a virtual learning environment, a free and open code, with an adequate didactic and technological flexibility. Moreover it is easy to use (4).

At the Higher Institute of Technologies and Applied Sciences in Habana, the study plan D started in 2007-2008, in the specialty of Radiochemistry. The General Chemistry subject is taught in the first year and its understanding is essential for the comprehension and quick articulation of the other branches of Chemistry which are studied later in that specialty. It is necessary for the Professor in General Chemistry to know in details the previous knowledge the students had before entering the Institute and to evaluate those they are going to receive during their first study year. On the other hand, students of the first year show great difficulties to assume independent study and a lack of abilities to process efficiently the wide volume of information. Memory learning, which characterizes the previous learning method, with which students got apparently good marks, is neither sustainable nor useful in time. It is necessary for the students, since the first years, to learn how to study, to think, to apply what has been taught, and to interrelate and integrate all knowledge. Special importance has the self-education process, understood as the process of self-perfecting, the structuring and restructuring of the personal reality and at the representation that student has about himself (5, 6). A course available on the platform Moodle as a tool of Open Educational Resources (OER) can be designed in a way that contributes to the development of the student's knowledge on himself (self-knowledge), to the temporary organization of life, to the understanding and seeking of information, and to the development of communication abilities framed as forming abilities of the personal development (FAPD) (7) and that reach their maximum expression through the self-education process.

In the researches carried out by several authors on the use of ICTs in the teaching-learning process on Chemistry, the results have been mainly focused on the non-personal components of the process: ways of teaching, methods and means, professor's role and that of the student, motivation and marks of the students at the exams, and degree of acceptance of the means used (8-14). However, the impact on the self-education process is not stated. In 2008-2009, at the Higher Institute of Technologies and Applied Sciences in Habana, some transmissible and interactive resources were proposed on Moodle to support the face-to-face course on General Chemistry for Nuclear Engineers, which had a good acceptance on part of the students (15). Therefore, the objective of the present work was to put into practice a course on General Chemistry for the students of Radiochemistry using the Platform Moodle as a support of the face-to-face course and to evaluate its impact in the process related to the self-education of the students.

## 2.-Methods and Materials

The course on General Chemistry on the platform Moodle was used as a complement of the face to face General Chemistry course. The former was programmed on a weekly format. The topic plan of the subject was placed on the platform and several activities were organized through transmissive, interactive and collaborative modules. The informative activities were digitalized on Word and PDF for Windows, and for the treatment of images, Photoshop was used. The activities of self-diagnosis of the previous knowledge of the students related with the study of the different topics were organized through questionnaires.

To evaluate the results, a survey among the students was designed and applied, and some discussion forums were allocated to know the fulfillment of the proposed aims.

## 3.-Results and Discussion

The work aimed at strengthening the students self-education through the use of ICTs with assignments leading to foster the development of forming abilities of the personality (7) such as: temporary organization of life, which leads to the stating and reaching of goals; expression and communication, an important aspect to create a favorable environment in the teaching-learning process; understanding and searching of information, which is an ability that allows students to know where to look for the information that is needed to understand a concept or a phenomenon or vice versa.

It was also pretended to facilitate the process of self-knowledge of the student through activities to stimulate the self-consciousness, self-reflection, self-valuation, among others self-referent processes, to help them in the orientation of their self-regulating and self-determination processes which are shown through their behaviors.

The resources and modules of the platform Moodle were selected with the aim of improving the forming abilities of the personal development. Table 1 shows the relationship between the forming abilities of the development of personality and the resources or activities of the modules of the platform Moodle which were used with that aim in the course.

Table 1: Relationship between the forming abilities of the development of personality and the resources or activities of the modules of the platform Moodle which can contribute to the student development.

FAPD	RESOURCES AND MODULES OF MOODLE
Temporal organization of life	Transmissive
	<ul style="list-style-type: none"> <li>• Setting of the course with a weekly format</li> <li>• Calendar</li> </ul>
	Interactive
	<ul style="list-style-type: none"> <li>• Questionnaires.</li> </ul>
	Communicative
Understanding	<ul style="list-style-type: none"> <li>• Messaging</li> </ul>
	Transmissive

and seeking of information	<ul style="list-style-type: none"> <li>• Compose a text page.</li> <li>• Link to a file</li> <li>• Display a directory</li> </ul>
	Interactive
	<ul style="list-style-type: none"> <li>• Questionnaires</li> <li>• Glossary</li> <li>• Assignments</li> </ul>
	Collaborative
	<ul style="list-style-type: none"> <li>• Discussion forums</li> </ul>
	Communicative
	<ul style="list-style-type: none"> <li>• Messaging</li> </ul>
Communication	Transmissive
	<ul style="list-style-type: none"> <li>• Compose a text page.</li> <li>• Link to a file</li> <li>• Display a directory</li> </ul>
	Interactive
	<ul style="list-style-type: none"> <li>• Questionnaires</li> <li>• Glossary</li> <li>• Assignments</li> </ul>
	Collaborative
	<ul style="list-style-type: none"> <li>• Discussion forums</li> </ul>
	Communicative
	<ul style="list-style-type: none"> <li>• Messaging</li> </ul>

It is considered that the modules and resources on the platform Moodle which appear in the table contribute to the temporary organization of life as follows:

- The setting of the course with a weekly format because it included the activity plan, both the face-to-face one as well as the on-line one. A special importance was given to the course planning because it facilitates the stating and reaching of the students' goals. The usage of time constitutes an essential element for the self-education process and the development of learning strategies (16), as a set of conscious procedures are considered, which are selected, regulated and evaluated by the student in relation to a specific objective and from a specific context of learning.

- A calendar as a reminder of the different activities which are going to take place during the week.

- The questionnaires because they are scheduled with a time limit for the carrying out of activities.

- Messaging as it allows enlarging communication according to needs and at the same time makes it possible to readjust the designed time to activities.

As for understanding and seeking of information:

- The questionnaires, glossaries and assignments allow the students to check their knowledge which facilitates the process of understanding. For example the possibility of setting the questionnaires with at least two attempts facilitates the students self-knowledge and the self-referent processes: self-conscience, self-evaluation, self-regulation, self-control, self-determination.

- Discussion forums facilitate the exchange of ideas which undoubtedly contributes to a better understanding of the treated topic.

- Messaging allows enlarging, clarifying and making the offered information pleasant.

As for communication:

- The transmissive modules enlarge and improve the information ways which lead to a better communication.

- The interactive modules allow the students to clarify doubts and exchange ideas which contribute to improve communication.

- The discussion forums make it possible to share criteria among students and with the professor, too.

- Messaging by itself facilitates communication.

After the implementation of the course using the platform Moodle as complement in the formation process, a survey among the students was applied.

In spite of the fact that a great importance was given to the course planning only 50% of the students considered positive the use of the course on platform Moodle to organize their time (figure1). The latter explains the fact that first year students are in the process of adaptation to the conditions of Higher education which rebounds in different ways, depending on their individual characteristics.

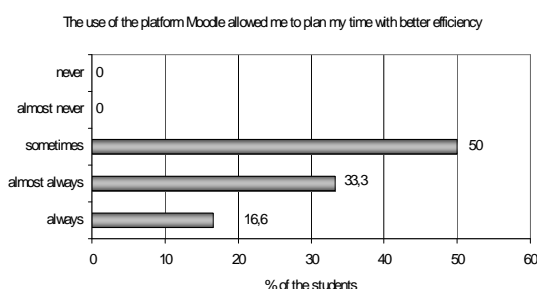


Figure1: Students' opinion about time planning

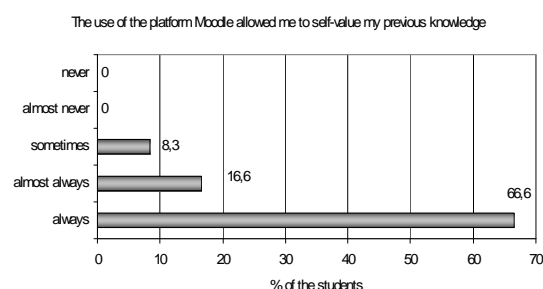


Figure 2: Students' opinion about self-valuation

The activities of self-preparation were placed for the conferences according to the different topics using transmissive modules. The necessary bibliography material was facilitated. The questionnaires were implemented to facilitate the self-diagnosis of the previous knowledge of the students which also facilitated to precise the difficulties on these topics and those of the individual differences of the students. 83% of the interviewed students considered as positive the opportunity of self-evaluation of their previous knowledge, offered through the conceived questionnaires for the self-diagnosis (figure 2).

In contrast with the previous applied forms to make diagnosis on the students (surveys, interviews, testing of knowledge with printed material), the use of the platform Moodle permitted a better efficiency in the time usage, as these activities could be developed in an asynchronous way. It was achieved the immediate feedback of the student on the mistakes made, the reception of the detailed information about students' results towards the professor, which allowed him to evaluate the weak aspects in the learning process. This contributed to a better characterization of the students through the activity bookmark, as it was possible to know the times and the time used in the utilization of materials. A similar experience was made (17) where collaborative

platforms were used as tools to study the process of learning on General Chemistry by integrating the face-to-face classes, the reading of the texts and the practical classes with the results of the diagnosis tests made on-line.

Besides, the orientations for the Chemistry laboratory work with images and animations were located on Moodle. 75% of the surveyed students said that the latter contributed to an objectively orientation in the performing of the laboratory practices (figure 3). Furthermore, the radiochemistry students were evaluated on-line more than once through this way, so they were inquired on this type of on-line evaluation and a good general valuation was obtained (figure 4).

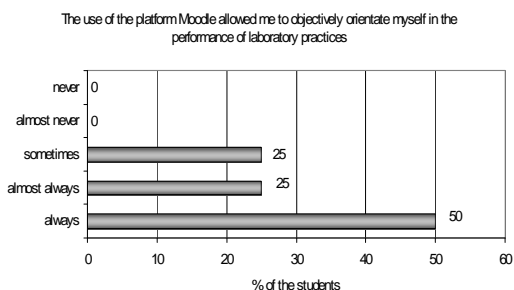


Figure 3: Students' opinion about laboratory practices.

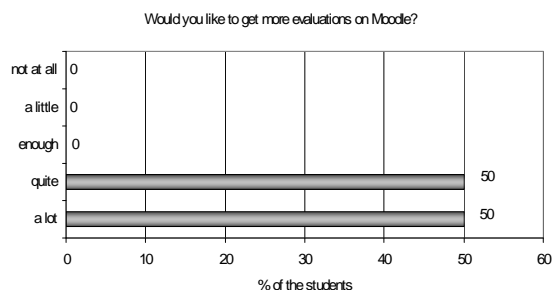


Figure 4: Students' opinion about evaluations on Moodle.

Another aspect to distinguish is that the radiochemistry students accepted the Moodle course in a favorable way, which is reflected when they say that they would like to have other courses on this platform (figure 5).

The preparation of the General Chemistry course for radiochemistry students took into account the continuous bettering of it, on the basis of reached experiences in the usage of the course on Moodle for Nuclear Engineers (15). Therefore there were more variants for the professor-student communication. A positive indicator of this aspect is that 83.2% of the students considered that through the use of the platform they could clarify their doubts easily (figure 6).

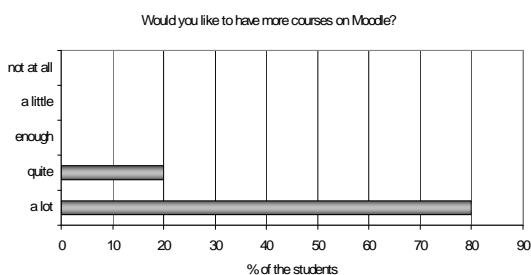


Figure 5: Students' opinion about courses on Moodle acceptance

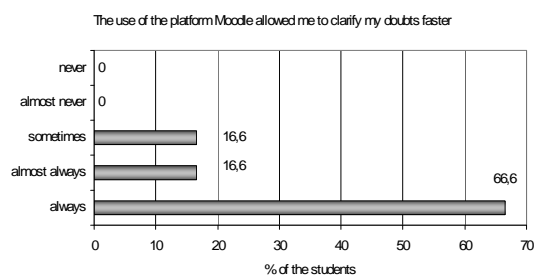


Figure 6: Students' opinion about possibilities of clarifying doubts

Another aspect to consider is that, on being a support course for the face to face one. The use of Moodle has the objective to complement the activities that are carried out in the face to face course. The results of the survey reflect a positive balance in that order (figure 7), as for the quality of the located materials on the platform (figure 8).

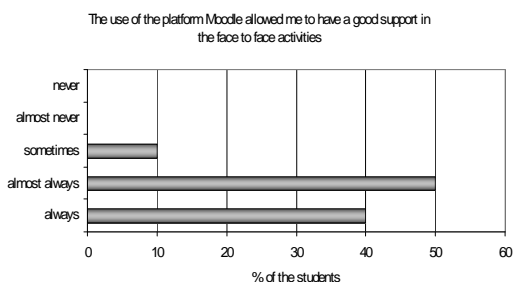


Figure 7: Students' opinion about the course as a complement of the face to face activities.

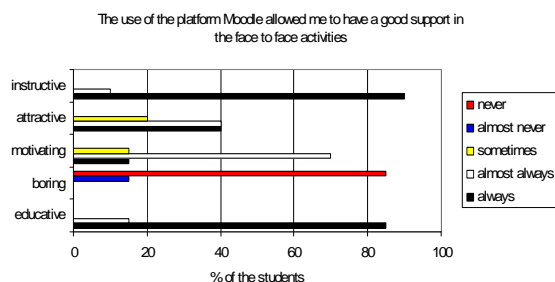


Figure 8: Students' opinion about materials on platform Moodle.

The students consider that they can recommend others the use of this on-line course (figure 9), as well as the satisfaction with the use of the platform (figure 10).

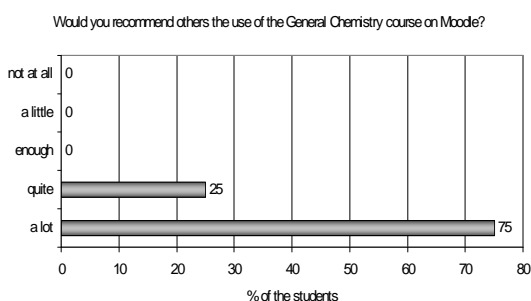


Figure 9: Students' opinion about the quality of General Chemistry Course on Moodle.

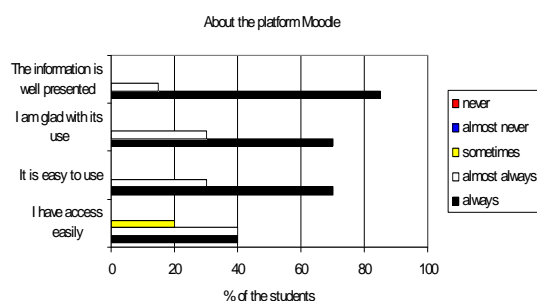


Figure 10: Students' opinion about platform Moodle.

The discussion forums have permitted to enlarge the exchange and communication possibilities. They were organized with different topics to gather the students' opinion. Examples are given below:

#### Forum 1:

Assess the impact on the General Chemistry course for your self-education.

Which aspects do you consider that contributed to your self-education and which ones did not?

Student 1: The course was of a great usefulness for me, though I know that I did not take advantage of the maximum time, but it helped me as a basis and leveling for the use of it in further courses. I think it helped me in the organization of my educational activities.

Student 2: It is good to be evaluated by that way because it is something different and in that form we can prepare ourselves better, taking advantage in a maximum way of all what we have.

Student 3: Through the systematic results I have achieved a greater and better organization in my studies.

Forum 2: From your point of student view, what advantages does it offer to count on a support course on General Chemistry on Moodle?



Student 1: As a student I think that it has been of a great usefulness and support. It has facilitated the development of our knowledge and potentials. I think that it should be enlarged (as it is being done) to the other courses of the semester.

Student 2: It is an advantage and not only for General Chemistry but with any other subject as it is a way of organizing the whole program of study, as well as obtaining quickly the complements of each course (practical classes, lectures...). I hope it will continue to grow so that it goes on fulfilling its objective.

Student 3: It is very good. I think it has been a great tool for us, in first year, because it helps us very much and organizes our studies, besides it saves time. I hope it will continue because it is a very good link with the professor and it serves as a way for our communication.

Student 4: The advantages are countless because counting on Moodle has facilitated my learning.

Forum 3: Assess the impact of knowledge through email of the systematic results of your evaluations for your self-education.

Student 1: It is a fast way and easy access way for all and I think that has rebound positively on us as it has offered not only the evaluations but also the behaviour of each of us inside the group.

Student 2: It is a good way of keeping the student updated in his path during the course.

Student 3: It is good to be evaluated that way as it is something different and in that form we can prepare ourselves better by taking advantage of all we have.

Student 4: Through the systematic results I have achieved a greater and better organization in my studies. These results are encouraging because they answer the proposed objectives.

The use of the platform permitted to reuse the created materials for the course. It facilitated the student's access to information, even from other places outside the institute. It is also considered to widen the experience to other subjects and specialties, which will enlarge the technological mastery for a better efficiency in the use of this resource on part of the students as well as the professors.

#### **4.-Conclusions**

The putting into practice of the first version on the General Chemistry course for radiochemistry students on platform Moodle contributed to the self-education of the students because there were:

- A better planning of individual study, preparation to carry out the laboratory practices, greater communication student-professor.
- The activities for the self-diagnosis of the previous knowledge facilitated to students a better self-consciousness on their own process of learning, which contributes to self-education process.
- Acceptance on part of the students of the use of this resource as a support of the face to face course.

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