

## **Virtual Learning Environment as a Conceptual Tool in Phase Equilibrium Course at Universidad de Los Andes.**

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Topics reviewed in phase equilibrium, may seem complex and difficult for many students. The mathematical background adds an abstraction level that makes difficult to observe the practical implementation and interpretation of phase equilibrium. Inconveniences such as these have been overtaken by developing a virtual teaching tool, designed project between the Chemical Engineering Department and Teaching Assistant laboratory at the Universidad of Los Andes. With this tool, students can see different fields of application of concepts such as free energy, partial molar properties, relation between phase equilibrium and chemical equilibrium. This virtual learning environment is an additional tool that allows the student to review their progress, reviewing specific topics such as pure compounds, thermodynamic properties of solutions, criteria of equilibrium. In addition to reading and study materials, invites the students to perceive the phase equilibrium as something real from the virtual reality and reflect on some examples of specific application linking the themes of the ongoing process with applications in chemical engineering. The results about acceptance of the course have been favored with this tool implementation.

### 1. Introduction

One aim of the project "Virtual Environments as the Higher Education Support Attendance at Universidad de los Andes", is to implement a system of monitoring and evaluation to ascertain the impact of Virtual Learning Environments – VLE - developed for undergraduate courses that have participated in the project.

The proposed Virtual Learning Environments is a proposal led by the academic rectorate at Universidad of the Andes. The project seeks to enhance educational processes VLE unconventional, to invite students to investigate, explore, learn, learn and expand on the subject of study. Similarly, the intention is to exploit the possibilities of multimedia and Hypermedia technology to support academic activities were present. Additionally, the project will seek to implement processes of planning, design, installation, implementation and evaluation of learning environments no physical presence. Finally, the VLE project seeks to promote relations between innovative content-student, student-teacher-student and student.

The implementation of the project is through a step-by-step methodology: Analysis of education, educational design, definition of the virtual learning environment, graphic design and computer, editing, programming, implementation, testing and adjustments and finally assessing the level of environmental impact virtual.

The evaluation of conducted process was inspired by some criteria:: Being a contextualized evaluation, giving voice to the participants to look beyond the numbers, look for an improvement in practice. To achieve this purpose the monitoring and evaluation system focuses both on the results generated in the VLE designed, as in the processes and conditions that enable the achievement of objectives.

## 2. Methodology.

In order to have a vision of the project, has designed an evaluation to identify, first, an overview of the process and the conditions of implementation and, secondly, an assessment of the results from measurements of central components of the course. This will define a time of 2 measurements, which constitute the basis of analysis to realize the potential changes generated in the courses. This will structure a formative assessment and summative which covers two academic semesters:

Base Line (LB): aims to record the development of courses and identifying information as the particular need identified in the analysis phase of education. This information corresponds to the course without the intervention of the virtual environment.

Line of Departure (LS) is focused on the valuation of the courses with the VLE running. The information is analyzed in relation to the earlier time, with the aim of identifying changes generated by the project in terms of educational need for the course.

From the analysis and design for the course of Thermochemistry II, it was determined that the students are difficult to abstract the cycle that occurs on the equilibrium of substances which are part of a natural situation, mathematical tools are used to calculate equilibriums and obtained an interpretation of the results in optimal conditions of operation.

Therefore, the objective of the VLE would strengthen the students in the abstract and evidence of the cycle that occurs on the equilibrium of substances from the approach of natural situations and the use of tools for calculating equilibriums through the demonstration in the learning environment. In that sense, it is clear that the VLE is a conceptual and that the theories of learning concepts share three basic assumptions (Bolton 1978): a. los concepts are formed through the recognition of similarities between objects, b. progress in the formation of concepts ranging from the particular to the general and c. the concepts are raw concrete, as they form the basis for the acquisition of more abstract concepts.

Thermochemistry II is a course that is issued to students from sixth semester of chemical engineering, whose goal is the conceptual understanding of the equilibrium of substances and how it can be used in industrial processes and transformations, the teacher explained that the course was not focuses on studying the separation of substances in them as conditions for the equilibrium of the same (one subject later shows them how is this separation). For him, that it can arise in terms of skills: to transform these processes into equations that students can handle, setting conditions for the changes they want can be made. At the starting line professor adds that the skill is expected in students refers to the ability of interpretation of the calculations made, integrating them together, "have to interpret that this equilibrium is demarcated in a series of steps that transforms a raw materials into products. "

For Professor at this time (baseline), it is important that the aid would provide the VLE to show the students that processes need to be very visual abstraction, so that they can draw conclusions from there: "generate a full cycle of abstraction, where this model applies, what can I interpret this model, and feedback from that. "

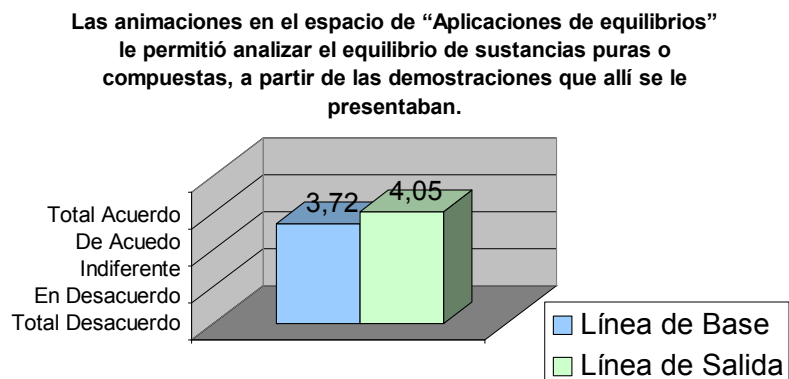
### 3. Results

The VLE of Thermochemistry II is composed of 1 space organization (Resource Center), 1 Information (Help), and 4 training (Board Room, Applications Equilibrium, multicomponent systems, and systems from a single component). The following describes the meaning of each of these areas:

1. One component systems: In this space the student starts the game of experimentation and exercises about three types of equilibriums: equilibrium Liquid - Liquid, equilibrium Liquid - Steam, equilibrium Liquid - Solid

At the student is proposing a challenge or problem to solve, if the student does not answer so successful, the tool gives feedback and offers the possibility to solve other challenges, to understand the conditions of a pure substance. In answering the questions correctly will continue with the experimentation of the case.

2. Multicomponent systems: In this space the student will do an analysis of the conditions of the substances, and the questions it will lead to perform the procedure to be able to abstract in terms of calculating balances. (Calculations made by those outside the tool.) What's interesting is the process that makes the student to take into account different types of substances and mixtures and solutions to the challenges proposed. As in the space above the tool gives you the ability to respond various types of questions if you do not hit it correctly solve the challenges continue with the case.
3. Applications balances: In this space the student experience from a real situation or event. This situation gives you an overview of how, from a physical situation, there is the analysis of the balance of substances, either pure or composite, this analysis lead the student to determine conditions.
4. Resource Center: Space for publishing documents to support the kinds of equilibrium liquid - liquid, liquid - vapor, liquid - solid, as well as links to other sites and all the resources necessary to achieve the objectives of the course.

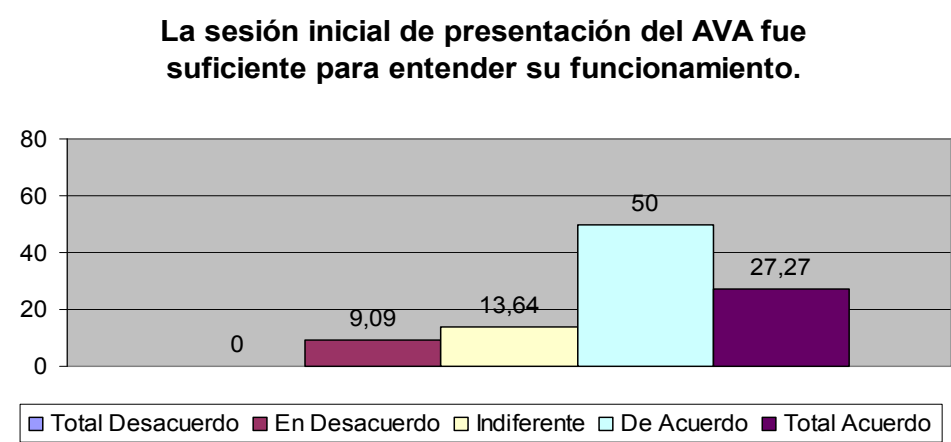


Space Applications Balance, composed of various kinds of animation, had a very good welcome from the students interviewed who entered this space, mainly because it seemed fun and useful to understand some content. One of the students said that

initially this kind of spaces he questioned many things that led him to ask the teacher: "Things that I was not clear. But I realized that with the animation. " The professor mentions that the sessions of listening to appoint this space laboratory by students, and how useful it was to understand the content. This corresponds with the results showing the above chart, which compares the importance of a certain type of resources in line with the basic line VLE in output, to analyze the balance of pure substances or complex: it looks like There is a trend the agreement ( $X = 4.05$ ).

### Integrating virtual presence

The initial presentation was held in a room of computers in which each student had his computer and witnessed how they sailed by the VLEs. For the observation was made of it, you can verify that it met all the requirements to make a presentation of quality: Deal introduced the charge of the spaces in its entirety, how to access them, clarifying the doubts techniques were taken, the professor for his part gave a presentation on the general sense was that each of these areas in order to achieve the educational goals of the course, making some students, chosen at random-resolved any of the exercises appeared in the exercised.



### Relationship between the VLE and educational need identified.

Bearing in mind that the educational need to be found in this course was that the students are difficult to abstract the cycle that occurred in the balance of substance, the professor believes that the VLE served as a source of questions, such as a space for The exercises they could get to see if wanted.

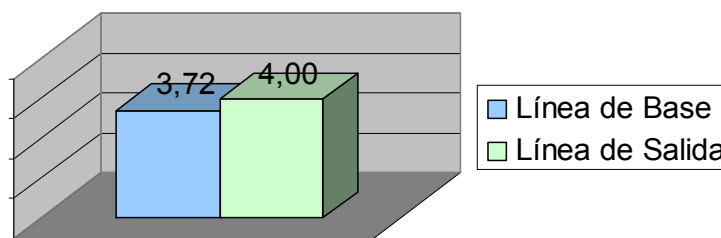
For its part the students believe that while the VLEs can not replace the experience of a laboratory presence, the area of the animations on the lot, "where one sees the mixture of moles combining with each other, it makes sense for the course." However, some students think they should put the focus not only on micro processes (in the interview refer to chemical levels) but also the industrial level.

### Evaluation of VLEs

Regarding the feedback that was online basic, and its importance to student learning, the contribution was significant in the VLE starting line, as shown in the chart below, which shows a greater tendency to agree that he had at baseline:

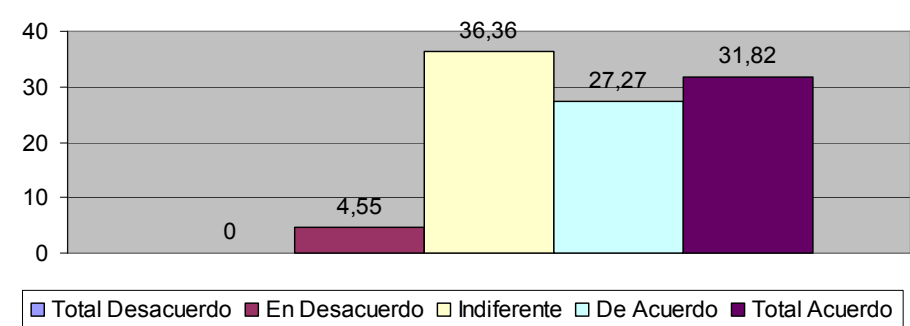
This is somewhat at odds with one of the problems that arose not because of a technical but management tool, and that has to do with the bank of questions that had been practicing for such spaces: the students stated that when got to answer the questions, they ended up going out after them repeat a cycle of four years.

**Las preguntas propuestas y la retroalimentación que se generaban por medio del AVA, le permitieron comprender que hay factores y condiciones para que se alcance el equilibrio de sustancias puras y compuestas.**



It can be said that both the feedback wrong, as the lack of questions may have varied disheartened those who were trying to find the VLE so frequent, which is understandable: the first generates a lack of credibility in the tool, the latter a feeling that no worthy of review by this means but to seek other remedies to go with the highest number of exercises, "a bored and was already" and answered all because I have nothing to learn "" At first I used it for the part but he knew that Gabriel was never going to get a question from there for the part. " This corresponds to the level of motivation that the students had to enter the VLE, and that as shown in the chart below shows a high percentage of students with indifference to the question (36.36%), while the rest tends to Total Agreement.

**Las actividades propuestas en el AVA resultaron motivantes, más allá de la nota.**



### Conclusions

For some interviewed students, there is a huge difference between the use and utility of a course with Sicua®, and the virtual environment that was for this course in terms of

learning: "There are very few subjects at the University who are as such a virtual environment in which one can try to measure the knowledge that one has acquired over the matter. " So this VLE managed to become some of the students in an area of significant exercise for the area.

Equally valuable is for students to have a tool that not only were to enter links to other pages (mention that this happens in other courses), but could interact with the VLE, to know its own course, as well as watching their own process throughout the semester to measure their level of knowledge. As can be seen in Annex 9.4, all students admitted at least once to see or do a test drill in spaces and some of them did so many times (one student showed up to 123 attempts).

Bearing in mind that the specific objectives that had this VLE, they had to do with giving students activities and problems to help them strengthen their capacity for analysis on the processes involved in balancing the separation of substances and compounds, it can be said that the was achieved successfully.

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