MITTEILUNGEN KLOSTERNEUBURG
66(2016) 8
www.mitt-klosterneuburg.com
Bimonthly ISSN: 0007-5922

EXPERIENCE TO USE OF ICT IN THE TEACHING - LEARNING IN VIRTUAL ENVIRONMENTS OF ALGEBRA

Julio C. Acosta, David L. la Red Martínez, Noemí Bachmann, Agustina M. Ramos.
9 de Julio 1449, (3400) Corrientes, Argentina, +54-379-4742772
julioaforever@yahoo.com, laredmartinez@gigared.com

ABSTRACT

We presented a technology development experience and teaching method in virtual environments distance and face that contribute to solving the problems caused by the massiveness. The experience took place in the subject Algebra of career degree in systems of the National University of the Northeast (UNNE). There are described the motivations that gave origin to the experience, the multimedia material used, its elaboration and modality of work, as well as the measurements of the quantitative results obtained so far. The topic is of full force and interest especially in institutions with massive demand for students (mainly in the early years). Experience that is presented is executed within the framework of the "Meaningful learning of Mathematics by B-Learning at the beginning of University studies", 12F003 RP, accredited before Secretary of Science and Technology of the UNNE which is continuation of the successive research projects called "The teaching – learning from la mathematical in environments virtual at the beginning of University studies" executed in the 2009-2012 period accredited before SCyT UNNE F005-2008; "Distance-learning of Algebra with computer resources at the University. A challenge using the NCTs" executed in the 2006-2008 biennium with accreditation before SCyT UNNE IP 102/06 and, "Elaboration of didactic Material computer-assisted for the subject Mathematics I", executed in the years 2004-2005, evaluated and accredited external Committee.

Key words: e-learning, multimedia materials for learning, distance education, b-learning.

1. INTRODUCTION

The overpopulation of students in the practical courses of the subject Algebra of career LSI (that between 2002 and 2008 averaging 140 students in each of the 6 groups of practical work), was impeding in some cases the comprehension of the contents, and certainly make materially impossible a desirable interaction of teacher - student in the process the teaching – learning.

We work on the development of technologies and methods of distance learning that contribute to precisely solve arising the problems of the massive; we boarded this problem as a product of multiple edges, among which we highlight: a) difference in the level of learning of previous contents in students, b) material impossibility of accommodating all the students in the classrooms of the faculty, c) low or null level of interaction teacher-student during the dictation of the subject, d) impossibility of tracking in the learning of students, e) little motivation for the study of basic science.

On new technologies of information and communication (NTICs), we were able detect new possibilities, applications and forms of teaching and learn mathematics and related subjects, as well as new ways of applying the concepts and mathematical methods.

We not pretended displace or replace eyewitness forms of teaching - learning, but rather seek to offer different alternatives for students who require different models for studying and learning. We believe that the new technologies of information and communication (NTICs) have the potential to play an important role by enabling a more effective approach, in the sense of allowing us too deeper and more persistent learning processes (Motsching-Pitrik & Holzinger, 2002) while the weight of an effective learning stays with people, their skills, and interpersonal values (Derntl, Hampel, Motschnig-Pitrik & Pitner, 2011).

In recent years has performed numerous works related to content production, currently has a global and comprehensive concept to e - learning (Nichols, 2003), which is that there is much to be done in the reengineering of the processes of learning for exploit the technology beyond the mere representation of content and their availability to be shared (Motsching-Pitrik & Holzinger, 2002).

These new scenarios include the combination of learning face to face and the supported by technological means (especially the Web), so that the fortresses of both configurations they can take advantage and exploit. This blended learning (blended learning or b-learning) is considered extremely useful not only for universities but also for society in general.

We have worked trying to provide students, in addition to and with the contents own of the subject, the four basic learning's proposed in the Delors report: 1. Learn to know and acquire the tools of understanding: learning to learn. 2. Learn how to make and influence the own environment: acquire skills. 3. Learn to live together. 4. Learn to be people. Our educational software (currently in use) in its initial version, it was designed with the fundamental premise that "be so simple that it's not necessary to learn how to use it" (Acosta & La Red Martinez, 2012); the material that uses the student to distance has to make up the absence of a teacher who continuously act as an intermediary between the student and knowledge, and therefore such material must have conditions that facilitate what (Holmberg, 1985) denominate as guided didactic conversation; and in the case of the material intended to be used for support or complementation of classroom teaching, must be equipped with everything you need to make it understandable (allow to visualize) situations of the disciplinary content that with traditional resources not always are accomplished and sometimes even are impossible to formulate them beyond the mere imagination.

The first scientific question of our research project: It is possible to teach - to learn Algebra for the career LSI distantly in the FaCENA? He had favorable response; it proved that this is possible, with the experience that is presented; and whose progress were presented at national and international events.

This work has structured in the following way: materials and related methods are described in section 2, the main results obtained are discussed in section 3, and some discussions are included in section 4, in section 5 summarizes the findings and indicated the future lines of work, ending with the references.

2. MATERIALS AND METHODS

Experience was executed under three well defined axes namely: a) the gathering of information about potential users of material, b) the development of a multimedia material for assistance in teaching - learning in virtual environments (EAEV) of students in Algebra LSI and c) measurement of the quantitative results obtained with the use of this material in courses or modalities implemented.

(a) We explore the preferences and knowledge of students in programming and operation in different programs and survey of needs, for the selection of tools and appropriate design of the system, with the assumption that in the following year, these characteristics would be similar. We have realized a survey to all of the students in the course of 2004, which yielded the first partial examination of the subject, 637 cases; and the situation of the potential users of the material we were going to develop you could meet. The questions addressed in General three aspects: i) kind of computer equipment that had students, operating software and prior knowledge of students in programming and operation of various programs; ii) Frequency and type of activity that they were opening then in the network iii) origin place and interest in a course to distance.

Of the results we obtained we could know or infer that: i) the totality of the students had access to a PC, but only 42,57% from their home, they had no difficulties in the operation of Windows, Word, Excel and Power Point, but they were unaware in significant percentages of other programs; a 90,40% did not operate Linux, percentage which it was increasing to 95.45% for math software, such as drift or Mathematica software; (ii) the students of the course 2004 they operated in network by 96,24%, of which only 13.22% did so from his home, a large majority of the rest did so from a cyber; the activity carried out by network was mostly chat and send - receive messages, only 29.50% it was sailing (We do not investigate about issues of preference); other information relevant to the effects of our work was that a 29.92% accessed the network as daily or almost daily, percentage that was increased 48,77% if we had people accessing the network at least once a week; (iii) we detected a 40,40% of potential who are interested in Algebra course to distance ; evaluation of the place of origin of the students and their choices, they revealed: If distribution is Corrientes (Capital and Interior) was 35% to distance vs. 65% face to face and to other provinces that choose to distance is increased: Misiones: 44.44%, Chaco: 45,15%, Formosa: 47,50% and others (North of Santa Fe, Santiago del Estero): 62,50%.

(b) We analyze disciplinary bibliography, relevant pedagogical fundamentals and technical information for the elaboration of the programmer.

The multimedia material of support for the course to distance is set of Power Point presentations at the disposal to students on a web site, with the resolution of practical work. Exercises and problems proposed in this presentation are exactly the same as proposed in the classroom, as a practical work guide. He does not claim this exhibition any more that facilitate to a better accommodation to the spaces and times of students, since it allows them to have an accompaniment to his studies, with facilitators who themselves may require a presentation, and pace suitable to their individual progress, or to the corroboration of the progress in work in small groups. The facilitators come from buttons that are placed at the foot of each exercise or problems, which lead to the resolution of the exercise in which suggest the solution, and parts that can move up to complete it, as required by the user; access to a glossary containing essential minimum theoretical concepts for the understanding of slogans, and basic properties of theoretical objects in game.

The material offers a frequent use of hyperlinks to relate content of different issues, following the basic conceptual network of the selection of content of the program, the problematic schemas and acquisition of skills in the use of the procedures.

Based on the technology and the means available then (year 2005) and the types of activities necessary for the development of the subject, we have designed our virtual classroom with minimum conditions to carry out an Algebra course to distance, She consisted finally in multimedia material referred and the possibility to consult how many times they were necessary the issues a tut (of the virtual classroom can say that: i) with regard to its architecture: the technology used was sufficient for educational functions that we set (communication and organizing); ii) with regard to the interaction with the guardian: to engage all communication through e-mail address: madimac@exa.unne.edu.ar the access was without restrictions of any kind - with the single feature that did not exist contact in real time, or via e- mail . The schedules of entry of e-mail addresses of students were registered in a band that was preferably of 10.30 o'clock in the morning and until 1.30 PM in the morning of the next day. Responses of the guardian is operated with a frequency of at least once a day - 16.00 AM to 18.00 hs - and sometimes two (an additional morning); the different characteristics, needs and interests of the students in some cases reflected in the diversification of the itineraries of work evidenced in your queries both the use of multimedia material and the same contents of the subject; iii) with respect to the tutor: the accompaniment and support of Professor in virtual tasks has been mainly essential at the beginning of the virtual course; It was possible to establish standards and clear criteria for monitoring and evaluation of the activity carried out virtually by the students and the midterms; iv) with regard to the type of activity: mode responded to specific realities that available technology can provide in our midst to this educational process, in a way that is not exclusive by the lack of the minimum resources necessary.

Evaluations for accreditation of the virtual group were the same, with the same topics and dates in the same classrooms which evaluates students face-to-face.

(c) In the quantitative evaluation was attended to the results recorded during a follow-up of six years, between 2005 and 2010 students of the virtual group and students from three groups selected witnesses, whose values are presented in figures 1 to 6 where the quantities are displayed and percentage in each group of students that: i) regularized the subject, ii) were free for faults[1] and iii) were free to adopt not partial. Neither students nor teachers were warned that their results were being measured.

The graphs of figures 7-12 present the performance of students in the groups studied in Algebra in the course calculus differential and Integral; it is the immediate correlative subject of Algebra.

The denomination of the groups appearing in the tables respond to the groups of Algebra; in calculating differential and Integral, the groups not kept, if not that students they were “mixed” again in different groups and different teachers in the generality of cases.

In the reading of the graphs of the Figures 7 it must consider 12 that the total of pupils who regularized Algebra, not necessarily coincides with the total of pupils that they dialed Differential and Integral Calculation, in reason of which there are pupils who, having regularized Algebra chose to register his inscription in Differential and Integral

[1] In the Virtual Group they are considered those students who have surrendered only one of the partials or none.

Wissenschaftliche Zeitschrift ISSN: 0007-5922

Calculation; this can owe to different motives, between which they stand out the abandon of the studies and not need to deal Differential and Integral Calculation, in raison of being, in these cases, pupils coursing Algebra again, which regularity in Differential and Integral Calculation has not won still.

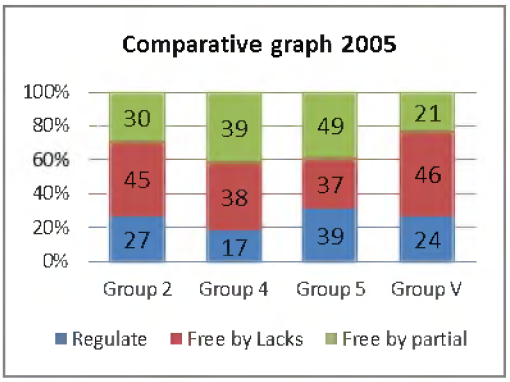

Figure 1

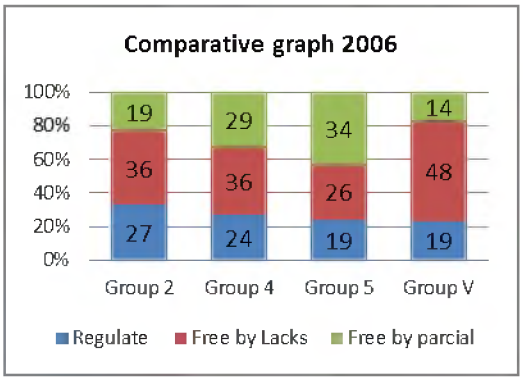

Figure 2

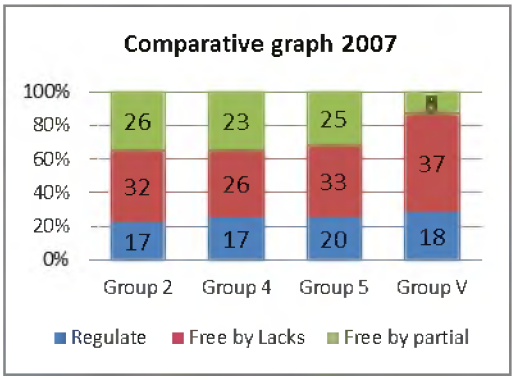

Figure 3

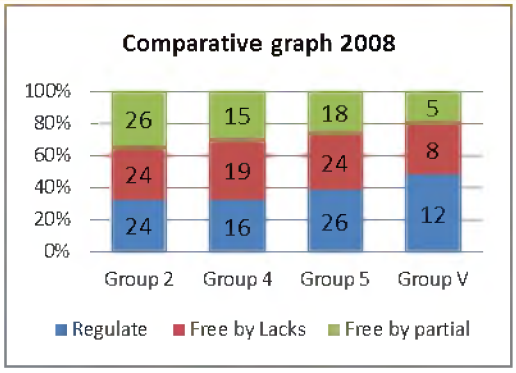

Figure 4

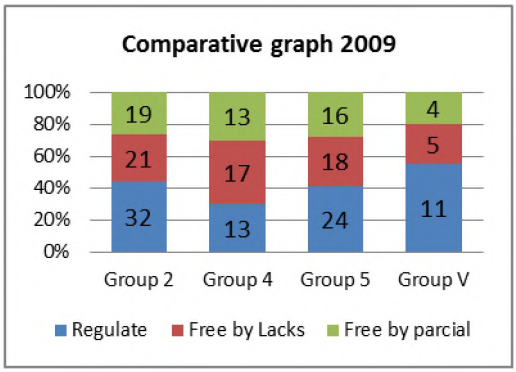

Figure 5

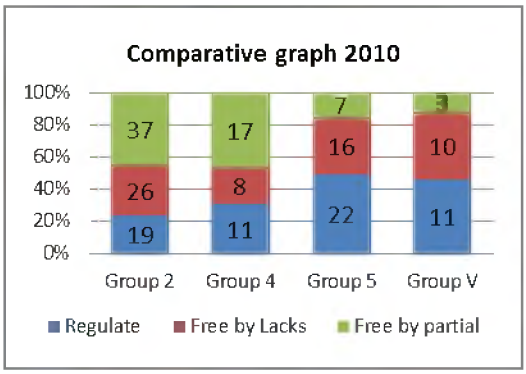

Figure 6

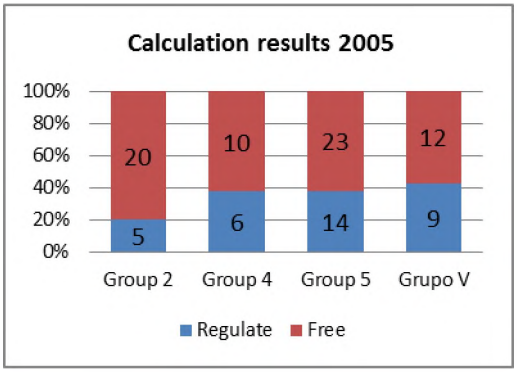

Figure 7

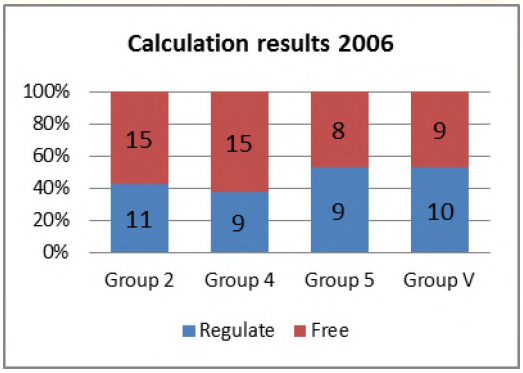

Figure 8

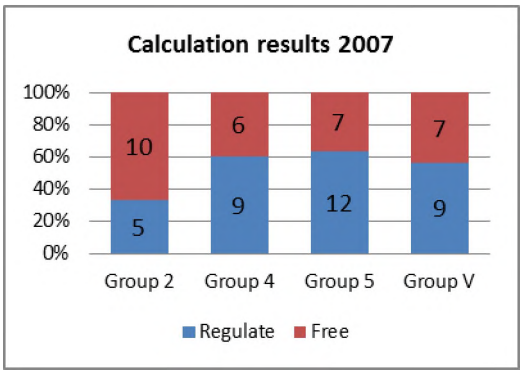

Figure 9

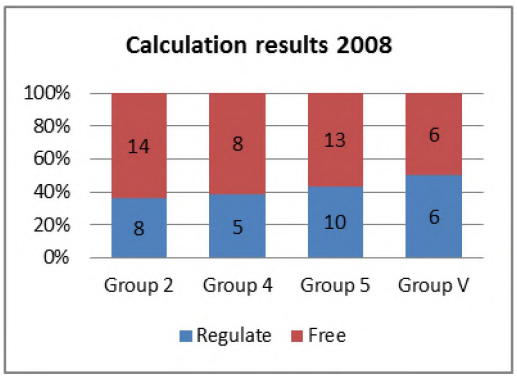

Figure 10

Weinbau ISSN: 0007-5922

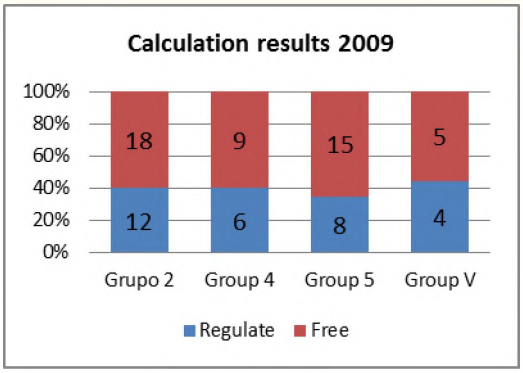

Figure 11

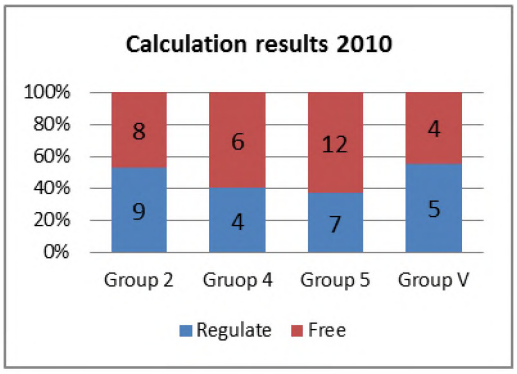

Figure 12

Is presented in addition in terms of quantitative studies and only like reference an analysis of the hours of study per week necessary for coursed of the subject in face-to-face and virtual modality. In order to know whether the system to distance is economizing or not study time, asked between presently students of Group 2 (one of the three groups of witnesses taken at random) and Virtual Group the courses 2005-2006; the two courses were considered, because that consider only one of them let us in some cases with samples of fewer than 30 cases, which is not advisable in the methods used; It is expected that the greater the size of the sample best statistical values is find and accordingly the inferences that they extracted are more approximate to the reality (Johnson & Kuby, 2003).

We work with four samples: i) students of Group 2 courses 2005-2006 reached Regular student status; ii) students in Group 2 of the courses 2005-2006 which did not reach the status of student Regular; iii) students of the Virtual courses 2005-2006 which reached the status of student Regular and iv) students of the Virtual courses 2005-2006 which did not reach the status of student Regular.

For the variable of "hours of study per week" were determined following values: less than 1 hour[2], 2 pm, 3 pm, 4 pm, 5 pm, 6 pm, 7 pm. or more[3] (table 1).

In this case, the first column contains the values of the variable "hours of study per week" and in columns the frequency with which the different values of the variable are presented in the sample.

[2] For 1 hs. or less, to the effects of the treatment and analysis of information we will consider 1 h.
[3] For 7 hs. or more, to the effects of the analysis we will consider 7 hs.

Of the averages obtained from the samples involved, $\bar{x}_{2R} = 4.17$; $\bar{x}_{2L} = 3.53$; $\bar{x}_{VR} = 3.98$; $\bar{x}_{VL} = 2.71$ in each group the average number of hours that regular students have studied is slightly exceeding the hours they free students studied and on the other hand, the difference in the average number of hours dedicated to the Studio for regular students of both groups is small, comparatively speaking, since it does not reach 0.20 hs (12 minutes); considering that the range of values for the variable goes less than an hour to more than 7 hours.

Hs stu	Group 2		GV	
	Reg	Free	Reg	Free
≤ 1	0	0	0	5
2	0	9	0	8
3	16	17	14	14
4	22	14	20	8
5	9	6	6	0
6	5	3	2	0
≥ 7	2	0	1	0
Total	54	49	43	35

Table 1

The values found of the dispersion measures proved:
For regular students of Group 2: $\sigma^2 = 1.13889$.
For free students of group 2: $\sigma^2 = 1.22865$.
For the regular students of the Virtual group: $\sigma^2 = 0.85992$.
To the students free of Virtual group: $\sigma^2 = 0.94694$.
This means that values more concentrated on the value of the average of the sample corresponding to the regular students of the Virtual group.
Standard deviation values obtained are:
For regular students of Group 2: $\sigma = 1.07$.
For free students of Group 2: $\sigma = 1.23$.
For the regular students of the Virtual group: $\sigma = 0.86$.
To the students free of Virtual group: $\sigma = 0.95$.

A useful measure to know at what distance from the average the value of one sample of either is, is the score z, by the formula:

$$z_i = \frac{x_i - \bar{x}}{\sigma_{n-1}}$$

where: x_i is the value of direct score of the sample in question, $\bar{x}$ is the average, σ_{n-1} standard deviation of the samples.

What the score z delivers is a weighting of the original values in terms of his distance with regard to the average, measured in units of standard deviation; results from a resignification of the direct score by reference to two values of the distribution: its average and its magnitude average variability (measured in units of standard deviation).

This is "a measure" to differentiate two values "equal" two collections of different values that have the same (or different) average and the same (or different) deviation (Johnson & Kuby, 2003).

We have studied the hours of study of the students who regularized the subject in Group 2 and the Virtual group; as we have seen, the means of both groups were: 4.17 hs and 3.98 hs respectively and their standard deviations: 1.07 and 0.86 respectively.

We evaluated the value 5 hs. of study for students in each of the groups:

$$z_2 = \frac{5 - 4.17}{1.07} = 0{,}775$$

$$z_V = \frac{5 - 3.98}{0.86} = 1.186$$

These results indicate that 5 hs. Of study in Group 2 are at a distance of 0.775 standard deviation from the average, while in the Virtual group is 1.186 standard deviation from the average for that group; words that can be interpreted as 5 hours. Study is comparatively, in the context of the Group's membership, in this case, more study time in the Virtual group than in the Group[4].

3. RESULTS

Of the exposed above, in the graphs of figures 1 to 6 arises that: a) the percentage of regular students in the Virtual group are higher or similar to one of the comparison groups; then, we can say that the distance mode is not, in principle, a system that generates difficulties to regularize the course; b) the percentage of students who does not render partials (desertion) in the Virtual group in comparison with witness groups is high, but the fact that the historical percentage of free students for faults (where they are including students who remain free by not render partials) he was held at the time, we think that such a situation could be due to the conditions of the distance learning course they favor that many students who in any situation would also abandon their studies, choose this mode; Another indicator of this could be high rates of students who work or in social situations unfavorable with regard to comparison groups[5]; c) the percentage of free students by partial in the Virtual group is significantly reduced, which may be due to that students enrolled in

[4] On having investigated the hours of study of the pupils of the Virtual Group, it was not considered the time that sued them to "see" for the first time every unit MaDiMAC 's, in raison of being this time the "equivalent" to the time of the class classroom in the witness groups.

[5] Information revealed in interviews.

mode, they assume the commitment of his studies with greater responsibility than the classroom, as well as the best use of the time which was discussion of the analysis of the score z; this interpretation would lead to the investigation of the relationship "virtual and face-to-face students" vs. "students active / liabilities"[6].

Of the results of the graphs of figures 7 to 12, where you register the performance they had in calculus differential and Integral students who regularized Algebra, in each of the groups studied; first confirmed the conclusions of the previous frame and we repeat before said, in the sense that the Virtual Group registered percentage of regular students who are not categorically different from those registered in the groups of witnesses, in some cases even they are superior. This was studied to dismiss the case situation that the Virtual Group in Algebra to have acceptable performance, but in the subject correlative immediate it evidences flaws that do not appear in the presently; however, in our case, in quantitative terms, confirmed the results, since the values found for the students in the Virtual group tell us that the Group had results that surpassed even the Group of comparison and surpassed in percentage to the entire subject.

4. DISCUSSION

Our results stimulate us to suggest this methodology - with the variants that the cases should impose - in the works of recovery of contents of the average level and of leveling for the revenue to the University.

We have been able to detect situations that they must attend the moment to think in EAEV courses and to be detailed below:

(a) of the teaching material: the design of the digitized, multimedia teaching materials or not, you must conform to the specific realities of the recipients, because if they are complicated in their conception and complex in their management, they are easily discarded by students; These value at the time of receiving the content, simplicity and plain language - why not devoid of scientific and formal rigor.

(b) Of the virtual classroom: our virtual classroom revealed "sufficient" for this phase of the project; from it we have failed to detect situations that can hardly register in classrooms of massive presence.

(c) The main advantages that we hold dear are focused on the fact that students have the opportunity of "learning to learn" within this organization, since become protagonists of their knowledge management. In particular, with the use of the innovation we are presenting, the times the students and teachers are better utilized, since we use a medium that still massive can be perceived by the user as personal because among other reasons: i) is used when user demand, ii) in the intimacy of the same screen, iii) requires constant interaction of search and acceptance of information.

Revealed themselves as the main difficulties for the implementation of the system at experimental level that: the design of teaching materials digitized, perform as a considerable time of preparation and should be performed by a specialist in the field of knowledge dealing with or by an expert in the use of ICTs with the permanent assistance of

[6] We would define as active students those that are managers interested in the development of his knowledge and liabilities those students who realize the "formal" activities, as regular assistance to class but with scanty participation and interest in the development of the subject.

the specialist in the field of knowledge dealing with. To this should be added that those involved in the preparation of the material must have special conditions for communication through the ICTs. While the virtual classroom was satisfactory to our experience, we have had difficulties such as: the provision of the network service has not always been the desirable.

Another difficulty that can occur when moving experience to another level, is that this experience was done in career degree in information systems and to take it to another race, where students, perhaps do not feel so identified with the use of the ICTs, mode might not have the same results in terms of accession.

5. CONCLUSIONS AND FUTURE WORK LINE

To sum up briefly the conclusions that have been reached, we can say the following:

That remote mode is not, in principle, a system that generates difficulties to regularize the Algebra course.

That the percentage of free students by partial in the Virtual Group is significantly reduced, which may be due to that students assume the commitment of his studies with greater responsibility than the classroom, making better use of the time.

That considering the performance that they had in Differential Calculus and Integral, the students who regularized Algebra, the virtual group recorded percentage of regular students who are not different from those registered in the groups witnesses, noting that in some cases are even higher.

Regarding the future work lines, the main ones are as follows:

Know, understand and explain the difficulties and advantages that arise in the application of the method of EAEV of Algebra for the Bachelor of Information Systems (LSI) FaCENA, when applied to other subjects, in this case the subjects: Mathematics I and Mathematics II (FCA: Faculty of Agricultural Sciences) and the recovery of content of secondary education for new students to the University.

Know, understand and explain the extent and the manner vary in which the various components of the teaching resources built for the EAEV in the new built-in subjects and their quantitative and qualitative results.

Formulate an architecture for b-learning (blended learning)[7], considering the principle of people-centered learning, and to provide appropriate support through the use of reusable patterns.

Know, understand and explain the differences, advantages and disadvantages in the teaching and learning of mathematics, with the application of an "architecture using patterns" in the b-learning.

Strengthen educational innovation that began in 2005 in the Chair Algebra, which consisted in the course of practical work of the subject to distance through virtual contacts and with support of multimedia material produced by the Ma.Di.M.A.C. Group.

Provide to the professorships of Mathematics and Mathematical of the FCA and to the pupil's initials of the career in Information systems LSI of the FaCENA, material of leveling in topics of Mathematics.

[7] Combined learning.

REFERENCES

Acosta, J., & La Red Martínez, D. (2012). Un aula virtual no convencional de Algebra en la FaCENA-UNNE. Saarbrücken: EAE.

Derntl, M., Hampel, T., Motschnig-Pitrik, R., & Pitner. (2011). Inclusive social tagging and its support in Web 2.0 services. Computers in Human Behavior, 27(4), 1460-1466.

Holmberg, B. (1985). Educación a distancia: Situación y perspectivas. Buenos Aires, Kapelusz.

Johnson, R., & Kuby, P. (2003). Estadística Elemental. Lo esencial. México DF: International Thomson Editores.

Motsching-Pitrik, R., & Holzinger, A. (2002). Student-centered teaching meets new media: concept and case study. Journal of Educational Technoplogy and Society, 5(4), 160-172.

Nichols, M. (. (2003). A theory for eLearning. Journal of Educational Technology and Society, 6(2), 1-10.