

**Online Financial Math Course.**

**An experience at University of São Paulo - USP/Brazil**

**Prof. José Dutra de Oliveira Neto, Ph. D.**

School of Economy, Administration and Accounting of Ribeirão Preto – USP -

dutra@usp.br

**Prof. Adriana Backx Noronha Viana, Ph. D.**

School of Economy, Administration and Accounting of Ribeirão Preto – USP -

backx@usp.br

**Prof. Irene Kazumi Miura, Ph. D.**

School of Economy, Administration and Accounting of Ribeirão Preto – USP -

ikmiura@usp.br

## **ABSTRACT**

*This research's objective is to present the results of an application of the financial math course using HP-12C in the virtual modality developed in the accounting department of FEARP/USP/Brazil utilizing a methodology for distance courses developed by the NPT research group. The WebCT™ environment was used for the course and were made available the theoretic contents, interactive and not interactive practice (video) and the business area applications. At the course's conclusion we collected the relative data of the student's participation, their evaluations and the perceived quality by the users through a questionnaire.*

*Key Words: Financial Mathematics, Webct, HP-12C, Methodology*

## **1 - Introduction**

Until 2006, MEC (Ministry of Education in Brazil) wants to increase to 500 thousand the number of vacancies of the higher education distance learning courses in the country. MEC believes the distance education is the most appropriate form to diminish the social exclusion in the Brazilian universities. The secretary of Distance Education, Joao Carlos Teatini (FOLHA, 2003), affirms there's a "lack of knowledge about the potential and about the quality of the virtual courses" in Brazil. (...) Other countries in the world have in the distance education a fundamental component for development. Given Brazil's dimensions and its exclusion, we can't give ourselves the luxury of not using the system in the appropriate form and strict quality.

According to Litwin (2001, 17) the use of the Internet's technology and its implantation are favorable once they are not considered obstacles, but a known support and already explored through entertainment activities.

The Internet appears, therefore as an alternative way to make the government's proposal of education democratization viable, whereas its access is growing every year in Brazil. Presently there are 11% (2003) of households with Internet access, being the total broad band providers grew from 694 (2002) to 1,199 in 2003 (TELECO, 2005). According to the Open and Distance Education Brazilian Yearbook (ABRAED, 2005) in 2004 1,137,908 students benefited from some distance course/program in Brazil, being that 309,957 were enrolled in courses/program offered by 166 credentialed entities in several programs levels. In the specific case of undergraduation and graduation level we can observe a growth of 13 programs in 2000 (1,758 enrollments) for 382 programs in 2004 (159,366 enrollments). More than half of the offers are in the

Southeast region that concentrates 53% of the distance students of the country (UOL, 2004) (FOLHA, 2004). The most used media in the DL is still printed (84%) followed by e-learning (63%) and CD-Rom (56%).

The figures indicate a large growth of DL in Brazil, but very inferior to the presence learning where in 2003 there were 3.9 million students (70% private education) in the undergraduation for 16,453 official programs (65.6% private) in 1,859 education institutions (88.9% private). A relevant fact that happened in 2003 is the fact that 42% of the vacancies of the private presencial higher education (50% of them are concentrated in the Southeast) weren't filled in by the 1.9 million middle school graduates. The reason may be the high investment cost for the presencial graduate courses in Brazil. Recent researches indicate that undergraduation students from the presencial higher education in Brazil (2004) are entering in the work market earlier than the students in 2002 (FSP, 2005) to help the family expenses. This means there may arise a competitive opportunity for the DL that have lower costs.

Recent researches show that 65 million Brazilians with more than 15 years of age abandoned school before completing the primary school (33 millions didn't complete the 4<sup>th</sup> grade and 16 millions are illiterate) mainly due to the necessity of working, lack of interest in studies and distance between home and school (FSP, 2004). Despite these obstacles 48% desire to retake studying, concludes the same research. The Brazilian government invests today only 4% of the Gross Domestic Product in education. Brazil has a population of 170 million people.

New researches in Brazil and abroad are being developed to improve the quality of education in the DL modality.

Although according to (ARBAUGH, 2000) evidence exists that teaching based on the Internet can improve the presence environment and give support to the students we have verified few empiric studies that validate this conclusion (HILTZ&WELLMAN,1997), (CACIQUE,2003), (PONZURICK,FRANCE , LOGAR,2000), (MAGALHÃES,1997),(SUNAL,D.W;SUNAL,C.S.;ODELL,M.R.;UNDBERG,C.A.,2003).

Considering the divergences in the obtained results can be derived from the lack of methodological strictness, we can conclude the necessity of a reliable and valid methodology to obtain the desired quality of the distance modality courses.

The objective of this work is to evaluate the results of the application of a financial mathematics course in the virtual modality using the proposed methodology developed by NPT research group. The variables to be analyzed involve activity participation, tests and perceived quality by the user through questionnaires.

## **2 – NPT® Methodology for DL course development**

In face of the necessity of reaching the desired teaching quality we used NPT® methodology to develop the course structure. This methodology is composed of three main dimensions: Virtual Pedagogy, Communication Technology and Quality. NPT is a research group in Distance Education composed by researchers of the University of Sao Paulo.

Each of the components presented in the figure 1 can be subdivided in stages, aiming the rational development of this course. We can observe in the Table 1 its analogy with the traditional structure defined in the literature for development of systems.

Figure 1 – Framework for the Virtual Learning Environment

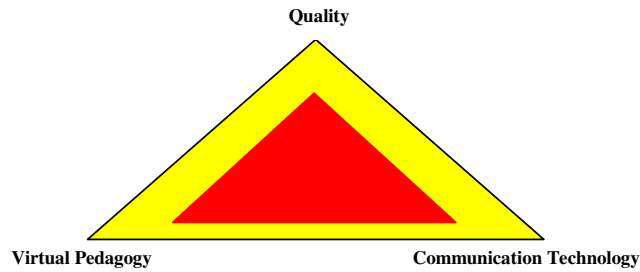


Table 1 - Virtual Learning Environment

Components of the Construction of Virtual Learning Environment	DL course Development Stages	Structure defined in literature
Virtual Pedagogy	Analysis Stage	Analysis
	Logic Project Stage	Planning/Project
Communication Technology	Physic Project Stage	
	Quality	Follow-up Stage
	Evaluation Stage	Maintenance

According to Maia et al. (2004) the DL *must be understood as a pedagogic activity in which the process of teaching and learning is accomplished through the mediation of a teacher and the use of didactic resources which are offered in different information and communication technological supports, used isolatedly or in conjunction.*

The financial mathematics course was developed according to this methodology and pre-tested in an accounting under-graduation class of FEARP-USP in 2004. FEARP-USP is an education unit of the University of Sao Paulo situated in the city of Ribeirão Preto, State of Sao Paulo, Brazil and was established in 1982 and includes 3 programs (undergraduate and graduation): Accounting, Business-Administration and Economy.

## 2.1 – Identification of the Sample

The target audience here involved is composed by beginners in Financial Mathematics and the objective was to capacitate the business professional with the correct financial math concepts using the HP12C calculator. The course was offered to the employees of Fundace (the FEARP Foundation for research support) with no previous experience in DL. We had a total of 10 enlisted people, being that only 9 finished the course. The course was developed at the Fundace building at alternative hours.

Table 1. Age

<b>Age</b>	<b>%</b>
<b><i>From 20 to 29 years</i></b>	66%
<b><i>From 30 to 39 years</i></b>	23%
<b><i>From 40 to 49 years</i></b>	11%

Table 2. Academic Formation/Background

<b>Level</b>	<b>%</b>
<b><i>Complete middle school</i></b>	23%
<b><i>Incomplete Higher Education</i></b>	44%
<b><i>Complete Higher Education</i></b>	33%

As we can observe in the table 1, there's a big variation in the participants age and also a minority has completed the higher education, as shows the table 2.

The requirements to accomplish the course were: dominate the use of the computer, of the Internet and basic notions of the HP12C calculator. According to response of the participants, the main objective is the need to learn how to deal with daily business decisions.

## **2.2 – Content**

The Financial Mathematics Course whose base content was used in the virtual course is lectured to under-graduation students in Accounting at FEARP-USP. The contents of each module were based on the books of Neto (200) and Lapponi (1995) and are presented in the table 3.

According to Neder (apud Oliveira et al., 2004) the didactic material is a strategic component in the DL once it's responsible for the dialogue between the DL components that is, between students, teachers and knowledge.

The didactic proposal of this course intends to rescue the theoretic fundamentals of financial math and apply the acquired knowledge in the real business world as a motivation form for the student. The pedagogic environment must privilege the individual learning process. The student can do the modular evaluations as many times as he wishes, with the intention to fixate better his concepts. The System generates random numbers each new accomplished evaluation. All the results (right or wrong) due from the evaluation accomplishment are stored and will be future objects in teaching individualization researches. The course possess visual resources for the HP-12C® use and permits the resolution of the problems presented in the theoretic content in an interactive or passive form using the Viewlett® software and virtual HP12C™ calculator.

Figure 1 – Interactive activity using Viewlett™ and HP12C™

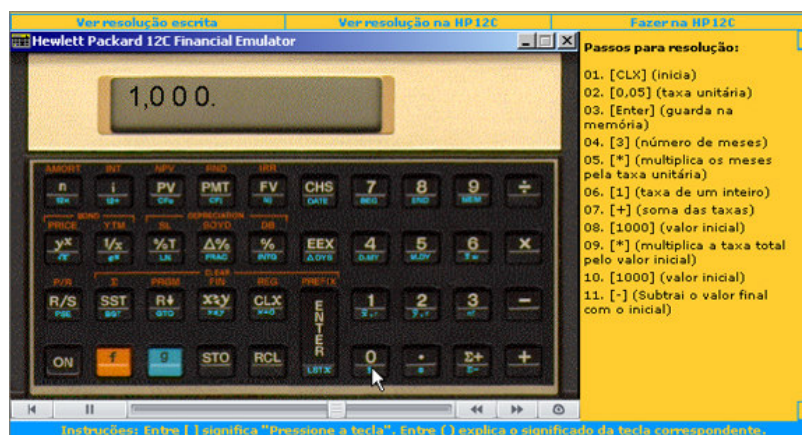


Table 3 – Course content

<b>Module 1</b>	<b>Module 2</b>	<b>Module 3</b>	<b>Module 4</b>
<i>Concepts: Interest, Interest Rate, Time</i>	Formulas: interest, capital, interest rate,	Formulas: amount, present value,	Concepts: Discounts



<i>unit</i>	term, amount and capital	compound interest rate and term	
<i>Cash Flow Diagram</i>	Proportional and Equivalent rates	Equivalent rates	Rational Discount or “inwards”
<i>Capitalization criteria: simple or compound</i>	Exact and commercial interest	Nominal and effective interest rate	Commercial Discount or “outwards”
	Financial Equivalence	Financial Equivalence	
		Rate of Return	

### 2.3 – Activities of the Tutor

After the course is prepared, it's necessary, at the moment it's available for the students, to have the tutors accompanying. The roll of the tutor according to Machado & Machado (2004) is the co-responsibility concerning the pedagogic, managerial, technical and social function. In the present course we allocated a previously trained student to do such a task.

### 2.4 – Webct™ tools used

Successful Distance Education involves much interactivity between teachers and students, between the students and the learning environment, and between the students. For this it is recommended the use of a Course Management System particularly developed to attend the virtual learning environment like, for example, the WebCT™. These environments provide desirable functions for a course in the DL modality like content hosting, design, interface, navigation, communication technology, evaluation and integrated control form. Below some used functions:

**Calendar:** place where the activity dates pertinent to the course are displayed, such as tests, essay deadlines, online meetings;

**Evaluation / Questionnaires:** in this item its possible to insert tests to evaluate the students – the tests are made online and the result is automatically sent to the professor/tutor. The evaluations of each module are made as the

student comprehends the theoretic content and practices by means of practical applications (exercises). With the exception of the final evaluation, the highest grade obtained in the modular evaluations remains. So that the final evaluation (exam) is automatically released to the student with an average of 7 (or superior) in the 4 modular evaluations.

**History:** Presents a history of the visited pages by the student;

**Discussion / Forum:** the discussion area is used for the information exchange and questions among the students (collaborative learning). According to Hiltz (apud Yokaichiya et al., 2004) the collaborative teaching can be a positive experience for the student: *knowledge seen as a social product and the educational process is facilitated by the social interaction in an environment that allows the collaboration of the colleagues, the evaluation and the cooperation.* The help given to the course colleagues is part of the students evaluation process (module 1, 2, 3 e 4);

**Chat:** Synchronous contact between the teacher and the student, or among the students in a pre-determined or scheduled time. The students must participate of at least one of the programmed chats for evaluation effects.

**E-mail:** traditional communication form.

**Activities:** Three activities during the course are developed as a group. It has a beginning and end date. The students observe the dates through the calendar and download the file with the activity description, discuss with their colleagues in the Forum and do the upload of a word® file with the answer;

**Approval:** to be approved in the course the student goes through qualitative evaluations (individual and collective participation in activities,

forums, chats) and quantitative evaluations (evaluation tests of the modules and final exam).

### 3 – Results

The course was performed in January 2005 with the support of 2 tutors and 1 coordinator professor. There were 3 chats programmed during the period and 3 business activities. There was no presence meeting during the course. The course was hosted at the NPT server ([www.npt.com.br](http://www.npt.com.br)) and is physically installed in a commercial server.

The collected data refers to the student's participation and evaluation and of the satisfaction questionnaire measured through tools available in the WebCT™ environment.

For each module the students had to complete a series of assignments: Reading of the content, Participate in the Chat, Develop group activities, Participate in the Forum, Develop applied exercises and module evaluation.

Table 5. Module 1 – Navigation table and test grade

	<i>Module 1</i>	<i>Module 2</i>	<i>Module 3</i>	<i>Module 4</i>
<i>Average hits</i>	16,8	30,6	30,9	13,9
<i>Average Grades</i>	8,6	9	9,7	8,7

The table 5 shows the student navigation inside the contents and the assignments required in the module 1. Some students navigated more than others. No reflection on the student's grades was accounted on this fact. The students could do the modular evaluations as many times necessary (prevailing always the higher grade) and not all enjoyed this benefit. In all 4 modular evaluations 10 students remade the tests, being that on the last evaluation (module 4) no one did a re-evaluation. Only two students couldn't improve their grade on the second attempt. Maybe this apparent lack of motivation is due to

the fact of the present course not being official and doesn't offer a certificate. The fact that the course doesn't offer a MEC certificate is one of the impacts on the high evasion indices in the distance courses in Brazil according to the Maia et al (2004) research.

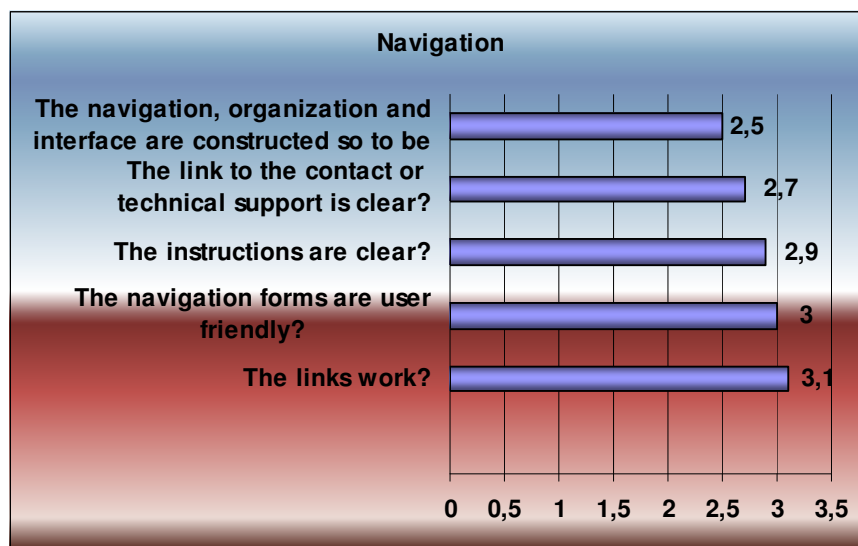
Table 12. Final Exam

<i>Student</i>	<i>A1</i>	<i>A2</i>	<i>A3</i>	<i>A4</i>	<i>A5</i>	<i>A6</i>	<i>A7</i>	<i>A8</i>	<i>A9</i>	<i>Average</i>
<i>Grade</i>	9.0	8.0	9.0	7.0	9.0	9.0	9.0	8.0	9.0	8,6

The final exam's release was automatic for those students who obtained averages equal or superior to 7 in the modular evaluations. Besides the modular evaluations, we ministered a user satisfaction questionnaire to stimulate the perceived quality by the user.

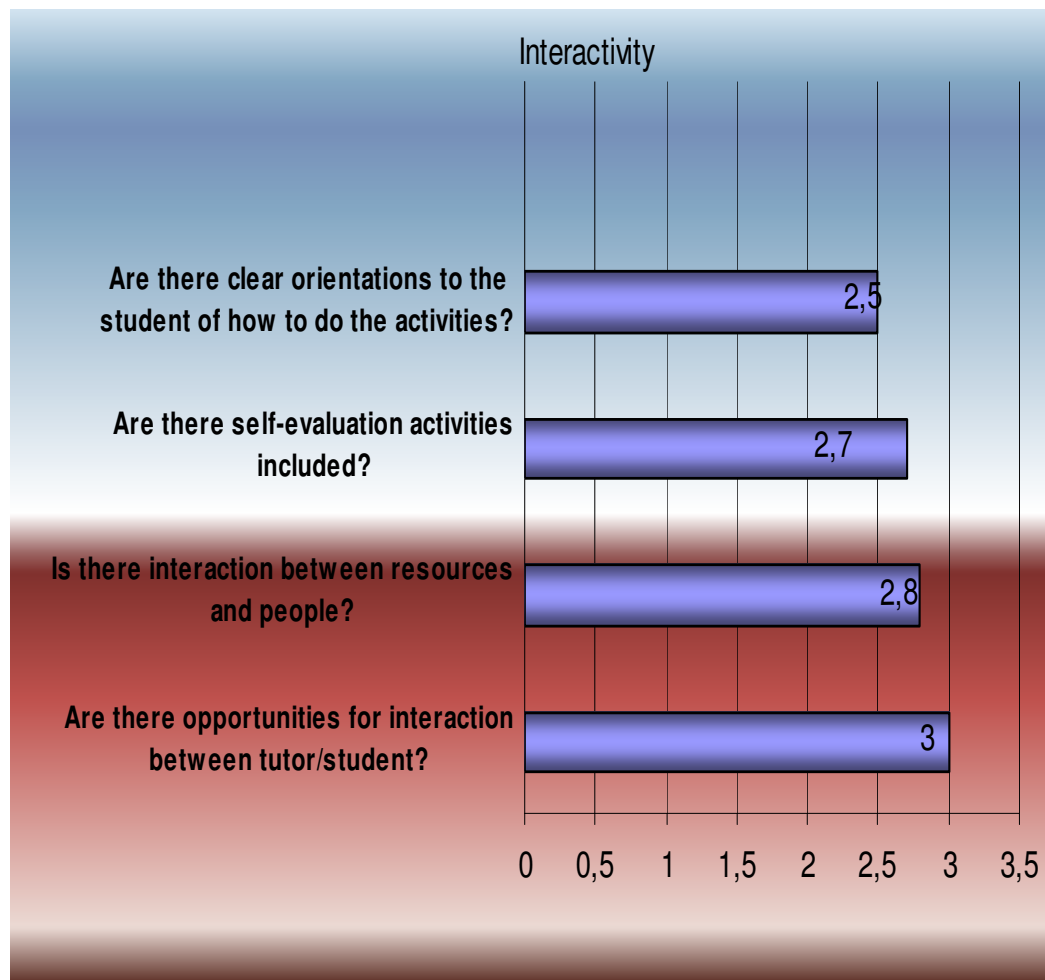
This questionnaire was called "Quality Standards in DL", in which he participants of the course identified the satisfaction level of the users in relation to the following dimensions: navigation, interactivity, support and quality indicators. We graded each topic based on a 5 point Likert scale (from 1 to 5, 5 being very high and 1 very low).

Graph 1. Navigation



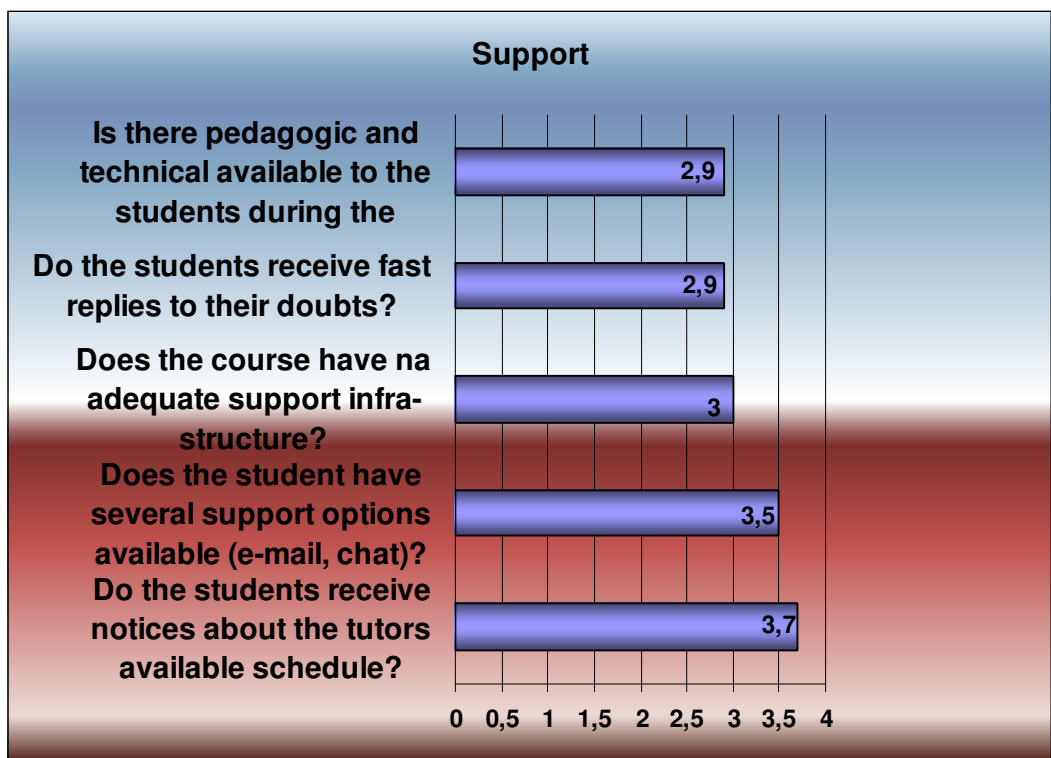
We can observe the item referring to the Navigation (Graph 1) obtained an average value of 2.84. Among the questions referring to this topic the one that had the best result (3.1) was about the functionality of the links and the one that got the worst result (2.5) was interface, which in the case of the WebCT™ environment was available only in english menu and has a different interface standard from Windows® that students are used to and this may have worsened the students acceptance.

Graph 2. Interactivity



It's observed on the item Interactivity (Graph 2) obtained the average value of 2.84. Among the questions referring to this topic the one that had the best result (3.0) was about the opportunity of interaction between the tutor and the student and the one that got the worst result (2.5) was the orientations on how to perform the activities maybe on behalf of the interaction necessity among the students to perform the activity.

Graph 3. Support



In the item referring to Support (Graph 3) obtained an average value of 3.2. This was the highest score between the 4 dimensions (Support, Interactivity ,Navigation and Quality) .This topic was evaluated best among the participants of the course and among the questions referring to it, the one that had the best result (3.7), best result in all the questions of the four topics, was about the receiving of the notices with the tutor's available hours. The ones that got the

worst results in this topic (2.9) were regarding the pedagogical and technical support and the reply to the student's questions.

Table 4. Quality Indicators.

<b>Question</b>	
<i>Resources like electronic mail, chat, with the colleagues contribute to avoid isolation and motivate learning.</i>	3,2
<i>Computers and Internet made it easier and more efficient to overcome distances and the teaching learning process more educative?</i>	3,1
<i>The interaction with students of the course helped solve exercises?</i>	3,0
<i>Reply time in the discussion list</i>	2,7
<i>The course had the same value as a presence course?</i>	1,9
<i>In your opinion the course qualified you to work in the studied area?</i>	2,7
<b>General average</b>	<b>2,76</b>

The item referring to the Quality Indicators (Table 4) presents an average value of 2.78. Among the questions referring to this topic the one that had the best result (3.1) was about the accepting of the new information and communication technologies (computers, Internet, etc) and that these made it easier and more efficient to overcome distances and the teaching learning process more educative. The one that got the worst result (1.9), worst result among all the questions of the four topics and below the average, was regarding the distance course having the same value of a course performed in presence.

It was verified through WebCT™'s administrative module that the participations in the chats and programmed activities were beyond expected; again we believe this to be in function of the low motivation to accomplish the course.

#### **4 – Final Considerations**

Considering that the presence education attends only a privileged portion of the population in conditions to attend a presence course and the Internet's exponential expansion in Brazil, the DL appears as an option of competitive teaching in the Country. Distance Education shall be more present in the Brazilian scenery in the next years, improving the deficient Brazilian education, providing a quality learning, enabling to overcome geographic distances, economical, social and cultural and democratizing the education opportunities in Brazil.

The present research uses a methodology for DL courses where it works the three main DL dimensions: Virtual Pedagogy, communication Technology and Quality and is in validation process with good success perspectives in function of the results reached until now.

In relation to the number of accesses we observe a great difference between the students, but with no evidence at the end of the evaluation. This may happen due to the student's prior experiences or his experience in the use of technology.

The possibility of the student doing several evaluations about each module was considered positive by the students and revealed, in most cases, better results in later evaluations.

The interaction among the students was low due to the lack of time, in function of most of the students not having a computer at home. And the interaction with the tutor was intensive, but with little patience on the students behalf, that wanted a reply in a lower period that the stipulated in the program.

The result of the quality research with the students obtained positive results with the exception of the item activities support that obtained a low



evaluation maybe because of the necessity of a larger interaction among the colleagues in the resolution of the group activities, which demands a form of communication and cooperation unknown to the students of the sample. The reply time was considered inadequate for students that want a reply in less than the 24 hours specified at the beginning of the course.

The quality indicators bring to knowledge the importance of the DL as an alternative in the teaching & learning process, but still don't have the same value as a presence course.

It is necessary to point out that the sample of users treated here is too small, and therefore it's not possible to make conclusions concerning the obtained results and new studies will be held still in 2005 in a new version as an official course at USP(University of São Paulo) and the CRC-SP (Regional Accounting Council - São Paulo Chapter).

New studies will be developed specially those dedicated to the individual differences by means of the analysis of cognitive styles and student learning styles and their impacts in the student's learning on virtual class. The ILS (Felder-Silverman model) and GEFT (Witkin et al., 1982) tools will be used to carry out future researches.

## **5 - Acknowledgements**

I would like to express my gratitude to the support from FAPESP(2005) in developing our present research in distance education.

## **6 - References**

ABRAED, **Anuário Brasileiro de Educação aberta e a distância** ,2005.

ARBAUGH,J.B., Virtual classroom versus physical classroom: an exploratory study of class discussion patterns and student learning in an asynchronous internet-based MBA course, **Journal of Management education**, Vol 24, N 2, pp.213-233, 2000.

CACIQUE,A., O ensino Presencia e Via Internet: Uma experiência comparativa em Educação a Distância,**ABED**, 2003

CONSTANTINO,L, Universitário brasileiro está mais pobre, **FSP**, 7-52005, p. C5.

FOLHA, 2003, <http://www1.folha.uol.com.br/folha/educacao/ult305u12535.shtml> accessed 4/20/2005.

FOLHA,2004

<http://www1.folha.uol.com.br/folha/educacao/ult305u17361.shtml>, accessed 4/25/2005.

HILTZ,S.R.,WELLMAN,B., Asynchronous learning networks as a virtual classroom, **Communication of the ACM**, 40(9),44-49,1997.

LAPPONI, Juan Carlos. **Matemática Financeira - uma abordagem moderna. São Paulo:** Lapponi Treinamento e Editora Ltda, 1995.

Litwin (2001,17)

LITWIN G. **Educação a distância, temas para o debate de uma nova agenda educativa**, Artmed, 2000

MACHADO,L.D., MACAHDO,E.C., O Papel da tutoria em ambientes de EAD, **ABED**, 2004.

MAGALHÃES,M.G.M., SCHIEL,D., A method of evaluation of a course delivered via the world wide web in Brazil. **The American journal of distance education**,II(2),p 64-69, 1997.

MAIA et al. Análise dos índices de evasão nos cursos superiores a distância do Brasil, **ABED**, 2004.

MAIA,M.M.,MEIRELLES,F.S., PELA, S.K., Análise dos índices de evasão nos cursos superiores a distância no Brasil, **ABED**, 2004.

MENA, F., 48% dos sem-estudo quer voltar a escola, **FSP**, 12-12-2004,p.C8.

NETO, A. A. **Matemática Financeira e suas aplicações**. Atlas, 2002.

OLIVEIRA et al., A Construção do material didático em EAD: uma experiência de aprender fazendo através de ação, do conhecimento e da efetividade, **ABED**, 2004.

PONZURICK,T.G., FRANCE,K.R., LOGAR,C.M., Delivering graduate marketing Education: An Analysis of face-to-face versus distance Education, **Journal of Marketing Education**, Vol 22, N 3, Dec 2000.

SUNAL,D.W.,SUNAL,C.S., ODELL,M.R., SUNDBERG,C.A., Research-supported Best practices for developing Online Learning, **Journal of Interactive Online Learning**, 2003.

TELECO, <http://www.teleco.com.br/internet.asp>, accessed 5/1/2005.

UOL ,2004 - <http://noticias.uol.com.br/educacao/ultnot/ult105u3411.jhtm> accessed 3/2/2005.

WITKIN,H.A., OLTMAN,P.K., RASKIN,E., KARP,S.A., **Group Embedded Figures Test**, Mind Garden.

YOKAICHIYA,D.K. et al, Aprendizagem colaborativa no ensino a distância – Análise da distância transacional, **ABED**, 2004.