THE EFFICIENCY OF CAL SUBJECT IN THE DEVELOPMENT OF MATH TEACHING COMPETENCES AND IN THE GROWING OF TEACHERS' SATISFACTION IN TEACHING

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Abstract: *The purpose of the present paper is to highlight the techniques achieved within the CAL (Computer Assisted Learning) subject for the development of didactic skills for math teaching, in the growing of pupils' interest for math learning and of the students (teachers) for CAL subject, and for the improving of teacher's job satisfaction. The conclusions drawn, after analyzing the questionnaires, the school documents, as well as the answers provided by the students on the occasion of the interviews we had with them, show that both their interest for the subject and their job satisfaction as well as their didactic skills are influenced first of all by the variety of the taught software within this course.*

Key words: *teacher's job satisfaction, didactic skills, interest, efficiency.*

1. Introduction

Computer-based instructional applications are considered an effective alternative to traditional teaching methods and today in numerous educational and training settings, interactive computer programs are used to teach young students and adults computer literacy skills (Varank, 2006).

The importance of training methods in computer literacy training programs was investigated (Desai, Richards & Eddy, 2000, as cited in Varank, 2006).

Computer-based instructional applications are considered an effective alternative to traditional teaching methods (Pucel & Stertz, 2005; Larkin, 2003; Leigh, 1996, as cited in Varank, 2006).

Computer assisted learning (CAL) is a method used to increase the efficiency of traditional educational approaches (lectures, exercises and laboratories), CAL is used in a great number of applications in education and training. CAL is particularly useful in challenging topics (Johnston, 2005) and provides a model in which the pupil /student plays a role and interacts with computer (Karacas & Tekindal, 2008).The CAL techniques are applicable to any field, however, and can be of significant help in illustrating

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concepts, in helping pupils/students to develop problem solving techniques (Chambers & Sprecher, 1983).

In traditional education geometry (mathematics) is learned through regularly studying textbooks, attending classes, taking notes and solving practical and theoretical problems. CAL is an instructional method which can be used to teach the content and practice of a geometry (mathematics) course. The advantages of CAL include an improvement in learning, a reduction of the learning time period and the development of quite positive attitudes towards CAL by the students (Chambers & Sprecher, 1983). According to some studies made in recent years, additional advantages of CAL are the achievement of activity-based teaching, the promotion of active learning, the enrichment of students by collaborative learning and the encouragement of students towards independent learning (Worthington, Welsh, Archer, Mindes & Forsyth, 1996; Spinelli, 2001; Prvan, Reid & Petocz, 2002).

Although in most European countries computer aided training is implemented successfully for many years, in Romania, we have still felt a trace of reluctance when discussing this mode of learning. Definitely we are in the technological age, and students' access to information is much higher than 20 years ago. The online libraries and educational web sites have offered to students many answers, but also the many question marks. We think we can say that because of the abundance of information through the media, through the Internet, more and more of the students are increasingly keen of knowledge of finding answers to various challenges that are offered by these media literacy. Because computer-aided training is not well implemented in the Romanian education system, students encounter their teaching – learning in the traditional way. They come to school with a lot of questions, curiosity that through this system will never be solved. This is one of the reasons for lack of interest appears to school.

Bertz and Johnson (2000, as cited in Varank, 2006) conducted a research study to determine the effectiveness of an innovative approach for teaching basic computer. The innovative approach was web-based which was administered over the internet, self-paced that required students to study on their own without attending a regular classroom instruction and competency-based that compared students' technical skills against certain norm.

Mathematics represents the method and the tool of work for all scientific and technical domains. This is the reason why this subject should be beautified through various activities that are taking place in the classroom, every time different, such as the pupils look it as a nice activity, appreciate it through its beautiful structure. Depends on the teacher, on the entire didactical strategy used, on the skills and the dedication of teacher work if is this subject will be loved or not by the pupils. Therefore it is important to equip teachers, and students who will become teachers with modern and interactive methods of teaching – learning, that have the goal to stimulate pupils on how to learn.

In any educational system, the teacher, considered as a professional undergoing continuous development, must follow successive training and evaluation stages (Cocorada, Pavalache-Ilie, Luca, Cazan, Truţa, 2015).

The teacher training must redefine itself according to the new standards of society and students' needs. The teacher should be able to create a learning context in which students can develop active and constructive processes of acquiring knowledge and skills that stimulate students to set their goals and take responsibility for their own learning activities and processes (Voinea, 2009).

2. Purpose and methodology of the research

The objective of our study is to identify the participant's perception on the efficiency of CAL course for the achievement of new skills for math teaching and for the growing of teaching satisfaction, the evolutions of their interest and of their pupils for the study.

The study involved a total number of 26 students from the program of conversion of teachers from school education in the mathematics field, developed in the Faculty of Mathematics and Computer Science, Transilvania University of Brasov IN AN ENGENIREENG FACULTY.

The distribution of participants was according to the next criteria: gender (6 males and 20 women) and age (26 to 56 years old, $M = 41.5$). Another criterion was the level of education and, as it can be seen from the graphic, most of the participants have graduated a bachelor degree (53% of the participants).
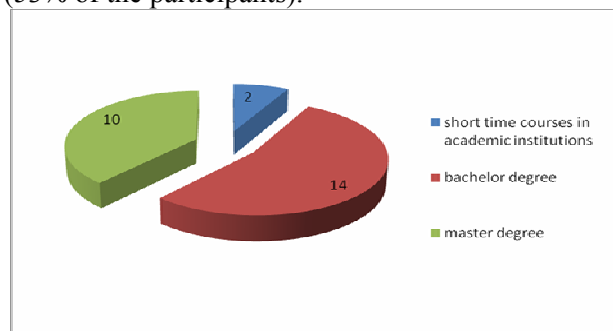

Fig. 1. *The distribution of participants by level of education*

Most of the participants have graduated institutions with technical or real profile and only a few participants have graduated humanistic profiles as it can be seen in figure 2.
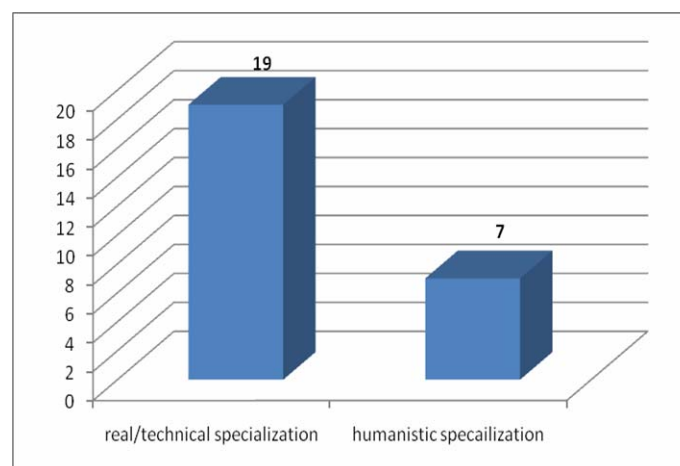

Fig. 2. *The distribution of participants by specialization*

Nineteen participants are teachers in secondary school, 5 in primary school, 1 is a preschool teacher and 1 is principal. We also asked the participants to tell us how many years they have in the work field (3 to 33 years, $M = 18.77$) and for how long they work in the present institution (1 to 27 years, $M = 12.27$ years).

To achieve the research purpose, the following methods were used: the study of curricular documents (syllabus from CAL course, the curricula of math conversion program) to identify the software taught to students, the used evaluation criteria, the number of hours allocated to the CAL subject; interviews with students (teachers) to identify teacher's job satisfaction in the math teaching and students' interest towards CAL course; the study of students' documents (obtained grades by students in CAL exam) to identify students' interest towards IAC subject, and the competences of math teaching achieved during the semester; a questionnaire for the students (teachers) with 17 questions based on students' experience in CAL course.

The questions approach four themes:

1. the students' perception regarding development of new competences for math teaching, acquired within this subject CAL (I1, I2, I8, I11, I12, I13, I15, I16);

I1*: Before the participation at this course have you followed a similar course?*

I2*: Have you used before the computer in your teaching-learning process at your classes?*

I8: *Do you recommend to your colleagues to follow these kinds of courses of computer assisted learning?*

I11*: Which software will you use in the future for the editing of a mathematics paper: Microsoft Equation from the Microsoft Office package or Latex?*

I12*: At this course you learned about different platforms and domains for the realization of personal web pages and blogs. Do you think that in the future you will disseminate the information (presentations, tests) with your students, using these virtual environments?*

I13: *Based on the notions presented and learned in the Computer assisted learning course, have you already realized lessons, presentations, tests for your students or have you participated at a scholar competition? If yes, please mention the name of the lesson, the used software and the place where it have been presented.*

I15: *The achieved information in the CAL course during the entire program was useful for your practical pedagogics?*

I16: *Do you consider that the achieved information in the CAL course come to grow the quality of your activity for teaching the new specialization which you will formed?*

 2. the students' perception regarding the connection between the increase pupils' interest for math learning and the use in teaching of analyzed software within the subject CAL (I6, I7, I17):

I6: *Do you consider that blended learning between the traditional style and those based on technology should bring an improvement on the students' interest for school?*

I7: *Do you consider that an animated, interactive, presentation with practical applications of some new notions using the CAL technics should construct a stronger connection between students and the taught subject?*

I17: *Do you consider that an interactive presentation with practical applications using CAL technics should lead to the interest's growing for mathematics and also to obtain performance or to improve the results at this subject?*

3. the students' perception regarding the connection between the increase of students' (teachers') interest for CAL *subject* and the variety of analyzed software within the *subject* (I3, I4, I5, I10, I14):

I3*: Have you interactive boards in your school?*

I4: *Is your school equipped with multimedia devices: computer, beamer, projection panels?*

I5: *Do you consider interesting the CAL course from the POSDRU project: The professional development of the teachers from preuniversitary school for new opportunities of development in career?*

I10: *Do you consider opportune the realization of some multimedia lessons taking into consideration your demands respecting the students' needs or do you prefer using of an application making by AEL?*

I14: *We are living in technology era, in a permanent evolution. On the market appeared smart phones and tablets which are very used by students. Do you think that it will be useful in the future, that CAL* subject *be taught on software for Android systems?*

4. the students' perception regarding the connection between the increase of teacher's job satisfaction and the variety of acquired techniques within the subject CAL (I9):

I9: Which of the software provided you liked more? Please rate from 1 to 5 each soft depending on the accessibility and the degree of practical utility.

The questionnaire was administrated to the participants to fill in a face to face meeting.

3. Findings

1. The analysis of syllabus of CAL subject showed the scientific content taught within this subject. The studied applications were adapted on the specific of this study program. Therefore, the studied software are:

1. PowerPoint – interactive lesson
2. Tests in PowerPoint using Visual Basic for Application
3. Questionnaires realized in Microsoft Office using Developer environment
4. Personalized animations using the software Screen Hunter and Gif Animator
5. The auto-assessment tests using Hot Potatoes
6. Slide Effect – interactive lessons
7. Prezi – interactive online lessons
8. Latex – math editor
9. Maple – math software

The students' interview realized at the beginning this course revealed that interest in the CAL was not very big, many of the students being reserved at the fact that the using of the computer in the teaching-learning process could represent for they a problem. At beginning they received the question: *Do you consider that the using of the computer in the teaching-learning process represents a benefit for students?* 48% from respondents gave a positive answer, 34% from respondents gave a negative answer and 18% from them abstained.

Due to the fact that the number of the reserved students was big enough, I had to approach another strategy to bring pros arguments and to arouse the interest for this subject and also to show the results that can be obtained with the help of CAL. All students were asked to think and then to expose how they see the presentation of the notions for the cone, such as the student goes home with the best understood notions. The main majority of the students said that they represent the cone on the blackboard. A part of them said that they will use a piece of hard paper to realize a cone. Those who already have had a different vision on this course searched on YouTube a movie regarding the

cone. Already the interest was increased. Then, the students were asked to realize a cone using Microsoft PowerPoint, and then using the animation to present gradually the way how the cone is realized. This was the critical point of the course, the students understanding the role of CAL and accepting that the own vision in the presentation of some notions represents a big plus to obtain a good result in the learning process of the student. At the end of the course, the students received the same question: *Do you consider that the using of the computer in the teaching-learning process represents a benefit for students?* All answers were affirmative, the students realized that the blended-learning technics are very useful in the abilities development and in the attraction of students' interest for the respective subject.

The students affirmed that at the end of the course they have already started to apply the taught notions at CAL course in their activity. Their answers were:

- *I presented in my school using Prezi, the lesson Pitagora Theorem*

- *I presented in my school using PowerPoint and Hot Potatoes, the lesson C++ Algorithmic, number matrices.*

- *I presented at communication for teachers using Prezi and PowerPoint the lessons: The mechanical work, The extern photoelectric effect, Hooke law*

- *I made a presentation in Prezi for the Analysis of methodic commission and CEAC.*

- *I made a presentation in Prezi at national conquest with the theme: Democracy and tolerance.*

- *I realized a presentation for a communication with the theme International Curriculum in Prezi and Microsoft Word.*

The analysis of syllabus of CAL subject showed the assessment of used methods. Therefore, all the participants at this course are required to achieve educational minisoftware that should contains mandatory an application for a lesson and an application for assessment test. Because this course is dedicated to the teachers which will became math teacher they must use the software with math formula. These formulas should be written in Latex, and after that it will be integrated with the other interactive software. The math interactive lessons are more complicated than those from other subjects due to the fact that much software are not compatible with math editors. The geometry interactive lessons are very difficult to create, and for this reason the involving of the teacher was higher. The final evaluation of this course was the presentation of the interactive lesson in front of the class. The students' interview realized at the end of the exam showed that this way of evaluation has increased the teacher's job satisfaction in math teaching.

At the question addressed to the students: Do you consider that this assessment type helped you to increase the satisfaction in math teaching? Their answers were:

-*I am very pleased that we succeeded in a short time to do an interactive application. Notions taught helped me to change my approach to a teaching lessons*

-*I understood that using the computer is not just a game. CAL is hard work, but the end results are extraordinary*

-*Evaluation using software taught is much faster and the feedback provided to students in real time is a big plus*

At the question: *Will you teach with much pleasure now when you know how to use the CAL technics instead the traditional methods with chalk and blackboard?* The students have declared:

-Blended learning is a great technique. It requires advanced computer knowledge and a assemble vision of all notions taught. I can say that it is like a play in which the teacher is the director and the actors are students. The teacher must have vision and know in advance what reactions will take the students

-Using the computers in teaching process represents a way to align our requirements and needs of students. Rewards offered through learning at the end of the tests make that learning to be regarded as a game and not something imposed by the teacher.

-I used software taught in circles, conferences and communication sessions. This has led to increased satisfaction in teaching.

2. The analysis of curricula of Mathematics Conversion program showed: the subject of computer assister learning has 28 hours of assisted activities on a semester.

3. The interviews with students (teachers) to identify their interest towards CAL course showed that at the start of the course 16 % from the students did not show any interest in the application of the methods offered by this course, 3.84% were quite apprehensive about the necessity of participating in such a course, being satisfied with the traditional teaching methods which were applied until now to the class, while at the end of the semester 95% of the students considered that their participation at this course was interested and useful, 80% from the involved students were really excited regarding the new learned methods.

4. The study of students' documents (obtained grades by students in CAL exam) showed that: the real interest of the students on how to apply the learned skills and the developing of the math teaching competences obtained through the using of the studied software, have arisen from the obtained grades by students in CAL exam: 25 students obtained 10 and only one student obtained 9. Even the assessment criteria presented above was not easy, the big results was obtained due to the extraordinary interest shown by the students for learning

We noticed that the interest in CAL and the development of new math teaching competences are highlighted in the results obtained.

5. The observation was applied on the entire semester and it was detected that the teacher's job satisfaction in the math teaching, has grown step by step, as the teachers progressed on the realization of the project, obtaining the final software regarding the interactive lesson that was systemized with the software: Microsoft Power Point, Prezi, Slide Effect.

6. The primary analysis of the results of the questionnaire, for the items I1, I2, I8, I11, I12, I13, I15, I16 that refer to the developing of new pedagogical skills on math teaching, obtained within the CAL subject is presented.

From the resulted items I1 and I2 arise that the students' knowledge in the CAL field at the beginning of the course. Hence 60.53% from the students have not had before any knowledge in the CAL field (I1), and 100% of the students have not known the software: Screen Hunter, Gif Animator, Hot Potatoes, Slide Effect, Latex and Maple; 96.16% of the students have not known the applications Prezi and Visual Basic for Application.

Student responses to the question regarding the item I8 highlighted that students appreciate that from the presented software at this course they succeeded to apply better in practice the following software: Microsoft PowerPoint – interactive presentations – M = 4.5 (maximum 5); HotPotatoes – M = 4.4 (maximum 5); Microsoft PowerPoint – test

using Visual Basic for Applications – M = 3.9 (maximum 5); Prezi – M = 3.77 (maximum 5); Slide Effect – M = 3.5 (maximum 5).

Students' responses to the question regarding the item I11 showed that: 69.23% from the students will text typing their math papers using Latex and will quit Microsoft Equation from the package Microsoft Office. Starting from the presented information at this course referring to the platforms and the domains for the realization of blogs and sites, in the item I12 the students were asked if in the future they will disseminate the information (presentations, subjects, tests) with the pupils through this virtual environment, 50% responded that they will realize a personal webpage where they will communicate easily with the pupils, 15.38% responded that they have already had a personal webpage, and 34.62% affirmed that they want to use the school's site.

The developing of the didactic skills of math teaching, obtained within CAL course, results from the students' answers at the item I13. When they were asked based on the learned notions within the computer assisted learning if they have already realized lessons, presentations or tests for their pupils or if they have participated at a scholar competition, most of those surveyed gave the following answers:

1. the analysis of methodology committee and CEAC – used software: Prezi.
2. the national conquest Democracy and tolerance – used software: Prezi.
3. communication session – international curriculum – used software Prezi and Microsoft Word.
4. mechanical work, the outside effect photoelectric, Hooke law – used software: Prezi and PowerPoint.
5. Algorithms in C++ - used software: PowerPoint and Hot Potatoes.
6. Pitagora's theorem – used software Prezi.
7. Water – used software PowerPoint.

A percentage of 50% of students mentioned at the item I15 that the obtained information within this course were in large measure useful in the period of practical pedagogics, for 34.62% of students the knowledge were largely useful during the practical pedagogics, and 15.38% of the students were indifferent. Interpreting this result, we can say that students who have been helpful the CAL knowledge in the sense to present the final lesson in teaching practice, had formed new didactic skills for teaching mathematics.

A percentage of 100% of students (teachers) mentioned at the item I16 that the obtained information within CAL subject come to support improving the quality of their teaching specializations in huge and largely measure.

Students' responses to the questions regarding the items: I6, I7, I17, targeted pupils' interest in Mathematics.

1. 84.62% of students (teachers) consider that a blended learning between the traditional style and on the one based on the high technology learned at CAL course, should bring an improvement on the pupils' interest for mathematics (I6).

2. 92.31% of students (teachers) consider that an animated, interactive presentation, with practical applications of some notions using the technics of computer-assisted learning should build a strong connection between pupils and the taught subject (I7).

3. 53.85% of students (teachers) consider that an interactive presentation, with practical applications of some new notions, using the CAL techniques should lead to the growing of pupils' interest for mathematics and to obtain the performance or to improve the results at this subject and 38,46% affirm that this thing is possible and it should be tried (I17).

The results of the questionnaire, for the items: I3, I4, I5, I10, I14, that targeted students' interest in CAL course indicate that there is a great interest for this course, demonstrated by the following results: 65.38% of students (teachers) have interactive boards in their school (I3), and 76.92% have the schools equipped with multimedia devices: computer/notebook, beamer, projection screens (I4). The existence into the schools of such equipment represents a possible explanation for the students' interest for the knowledge achievement necessary for their utilization. 100% of students (teachers) consider that CAL course is interesting and useful in the didactic activity (I5). The interest for this course results also from the fact that 76.92% of students (teachers) consider appropriate the realization of a multimedia lesson, respecting the own requirements, reporting directly to the pupils' needs (I10). The interest for CAL subject results from the fact that 69.23% of students (teachers) affirm that they would like to learn how to realize educational lessons and tests compatible with the Android operating system (I14).

The item I9 of the questionnaire, that targeted teacher's job satisfaction indicates that this grows during the utilization within math lessons of the learned software at CAL subject, as it follows: Microsoft PowerPoint – interactive presentations – $M = 4.9$ (maximum 5); Hot Potatoes – $M = 4.40$ (maximum 5); Microsoft PowerPoint – tests using Visual Basic for Applications – $M = 3.90$ (maximum 5); Prezi – $M = 3.6$ (maximum 5); Slide Effect – aver $M = 3.63$ (maximum 5).

5. Conclusions

The research conducted has led to the following conclusions: the acquired technics within CAL subject determine the developing to students (teachers) of new competences for math teaching, but they can be used also in the teaching of initial teachers' formation.

Student' interest in CAL is first of all determined by the variety of analyzed software, the most appreciated are: Microsoft PowerPoint and Hot Potatoes, by the way how the continuous and final evaluation is realized at this subject, but also by the equipment existent into the school.

The students' interview realized at the end of this course revealed that interest in the CAL subject increased with the completion of the scientific content. By learning each software, students have formed new teaching mathematics skills.

The pupils' interest for math lessons, after the teachers' opinion is positive influenced if through the used strategies are also introduced the learned software at the CAL course.

Another conclusion is that teacher's job satisfaction is determined by the way in which the assessment of CAL knowledge is done.

Comparing different groups of participants at CAL course we can make the next observations:

- The interest of those younger with the age up to 40 years old (11 students) was increaser for CAL subject due to the skills in work with computer; the students with age between 41 and 55 years old (14 students) have shown a lower interest, but they tried to be competitive and keep pace with the younger students, only one student with the age over 55 years old didn't success to assimilate al taught software.

- At all 4 themes, the best results were obtained by those with technical preparation (physics, chemistry, economics, informatics, mechanics). The lowest results from the

point of the presentation of the lesson were obtained by those with humanistic preparation (schoolteacher, educators).

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