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The use of computer-assisted Experimentation (CAEx) in Moroccan schools

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Abstract: The computer-assisted testing (CAEx) is a method of construction and operation of measures using the computer. It has an important use of CTI in experimental sciences field. The CAEx equipment includes a computer interface and associated with different sensors. It allows real-time measurement of various physical parameters changes, biological.

Our study is a collection of information on the types of sensors used in high schools, the appreciation of the type of teacher training teachers in the use of CAEx, measuring the level of use of this tool in experiences in class and possibly the benefits and advantages provided by this tool.

In this work, we made some experiments of CAEx tool. We did a survey on the use of CAEx which was to write a questionnaire that focused on equipping schools in CAEx, training of teachers CAEx, the frequency of use of this tool and its contribution to class.

We then distributed the questionnaire to teachers of physics in several Moroccan schools; This was a sample of 50.

It is clear from this survey that CAEx can:

- Gain time
- Present values and more accurate results
- Make less effort to achieve his goals

At first, we presented computer-aided experiments which we have reproduced in the laboratory.

In a second step, we checked the level of use of CAEx by teachers, and eventually enjoyed the benefits that bring them of CAEx.

Keywords: CAEx , physical experiments , physical-chemistry, school teachers-CAEx.

1. Introduction physical Chemistry

Within the scientific disciplines, greater emphasis is placed on experimentation. However, for this scientific experiment allows the understanding of complex concepts, it must be accompanied by presentations by the teacher. The integration of new computerized learning tools used to make these presentations interactive and meaningful for students, including [1] sciences.

The Experiment Computer Aided (CAEx) is an important area of use of ICT in the experimental sciences, it interact with a real experimentation through an interface provided with sensors and connected to a computer to collect the data, represent and analyze different [2] levels. The CAEx allows for experiences, to acquire and exploit measurements using the computer. The student is thus placed in a real lab environment allow it to design, plan and carry out experiments in physics, electronics, chemistry, biology, geology and technology [3]. Several acronyms and expressions are equivalent CAEx including: Beadle Robot Educational Robotics, ATIDEX for Acquisition and Computer Processing of experimental data, MBL for Microcomputer-Based Laboratory and CAEx for Computer-Assisted Experimentation [4]. The CAEx enables students to both configure and control a real experience, acquire data and display them in symbolic forms. [5] Thus, any CAEx system consists of the same elements: The Experiment Computer Aided (CAEx) is an important area of use of ICT in the experimental sciences, it interact with a real experimentation through an interface provided with sensors and connected to a computer to collect the data, represent and analyze different [2] levels. The CAEx allows for experiences, to acquire and exploit measurements using the computer. The student is thus placed in a real lab environment allow it to design, plan and carry out experiments in physics, electronics, chemistry, biology, geology and technology [3]. Several acronyms and expressions are equivalent CAEx including: Beadle Robot Educational Robotics, ATIDEX for Acquisition and Computer Processing of experimental data, MBL for Microcomputer-Based Laboratory and CAEx for Computer-Assisted Experimentation [4]. The CAEx enables students to both configure and control a real experience, acquire data and display them in symbolic forms. [5] Thus, any CAEx system consists of the same elements:

A sensor that measures the change of a physical quantity from a biological phenomenon and generates an analog electrical signal whose value is proportional to the measured parameter.
The electrical signal from the sensor is applied to an acquisition interface including an analog / digital converter. The interface converts analog signals into digital signals it sends to the computer.
A pilot adequate software interface and allows you to process measurements, including graphically.
All studies and experiences of countries that have adopted the CAEx showed that provides effective solutions for teaching physics. With CAEx, the tedious and repetitive taking action gives way to reflection on the use of these measures, the meaning and interpretation of the results. [6]
The CAEx because she still keeps in touch with reality, can develop an inductive thinking in students. It allows the student to pass a physical variable to the mathematical expression that represents it. For example, the student observes multiple shots of the same phenomenon data and graphs. Later, he tries to generalize his observations in the form of rules, laws, etc. [7].
The decision to implement the CAEx in Morocco's education was taken by the Department since 2009. In Morocco, the official programs of high school and college classes, invite to use these electronic resources that are now parts of the ICT program the Regional Centres for Careers Education and Training.
According to the decision of the government to equip the different high schools in CAEx equipment and to train teachers to be able to use it, we think of CAEx is dominant in Moroccan schools and becomes a regular tool for teachers. Indeed, in 2009, the Department has acquired 924 CAEx kits (SPC 513 for laboratory physics and 411 for those in the life sciences and earth). This corresponds to the massive acquisition of 14 Regional Academies of Education and Training. The effort was begun continued between 2010 and 2012. Currently, teaching equipment (CAEx and science education) remains a priority in Morocco. [8]
The CAEx is a modern educational tool to improve the level of learning among students and to facilitate the teacher's roles. However, some questions arise:
Is Moroccan schools are equipped CAEx? Does the CAEx is used by teachers? And what does the CAEx in the lesson physical sciences?
We propose in this work to identify various existing sensors in the accompanying high schools and their level of use by teachers, and possibly enjoy the benefits that brings them CAEx. To do this we have developed a paper questionnaire for teachers about the use of CAEx. We left the following assumptions:
-the most Moroccan high schools are equipped with hardware necessary for CAEx (range of sensors: voltage sensor, electric current sensor, pH sensor, motion sensor, magnetic field sensor, pressure sensor, meter sensor drop)
- The teachers were trained in the use of CAEx;
-The program experiences that address the CAEx are easily achievable, they do not take much time and they are effective;
-the use of CAEx by teachers in physics and chemistry experiments is almost universal.
To test these hypotheses, we have prepared a questionnaire for physics teachers from several schools.

2. Research Methodology:

First, we exposed the computer-assisted experiments we have reproduced in the laboratory.
Secondly, to test our hypotheses, we have prepared a questionnaire that focused on equipping schools in CAEx, teacher training CAEx, the frequency of use of this tool and its contribution in the classroom.
We distributed the questionnaire to physical science teachers 4 Moroccan schools, we also have distributed to trainers of teachers CRMEF physical science sections.
The number of distributed questionnaires was 100. We received 70 completed questionnaires and thus the number of abstentions was important. We then had to conduct interviews with professors of physics at the various accompanying high schools, in order to do our analysis.

3. Results and discussion:

The counting of the questionnaire is as follows:
-**The Questions 1 to 3** on the age of teachers and the nature of the institution show that most teachers above 20 years of service, teachers of private schools have declined to answer the questionnaire.
-**For Questions 4, 5 and 6**: your institution be equipped CAEx material? And if so what are there that the sensors are?
Through the survey, we see that the surveyed establishments are equipped hardware 98% CAEx.
High schools considered are equipped with software logger pro Vernier LabQuest interface. Sensors found there are:
• voltage sensor
• electric current sensor
• pH sensor

• conductivity sensor
• pressure sensor
• the magnetic field sensor
The methods of measuring magnetic fields are quite numerous and there are several principles of magnetic sensors (which are very expensive), from the simplest of commonly used in industrial or consumer, to complex, often restricted to laboratories or very specific applications.
The need has been felt for the meter sensor drop or it can be replaced by a single dosing, but the motion sensor that works with the Doppler effect is actually missing and there is a problem.
In CRMEF, the software used is Latispro with the SySAM V6 interface and the following sensors:
• pH sensor
• conductivity sensor
• pressure sensor
• the magnetic field sensor
• temperature sensor
For Question 7: Have you received training in the use of CAEx?
The figure. 1 below shows the percentage of high school teachers trained in CAEx:

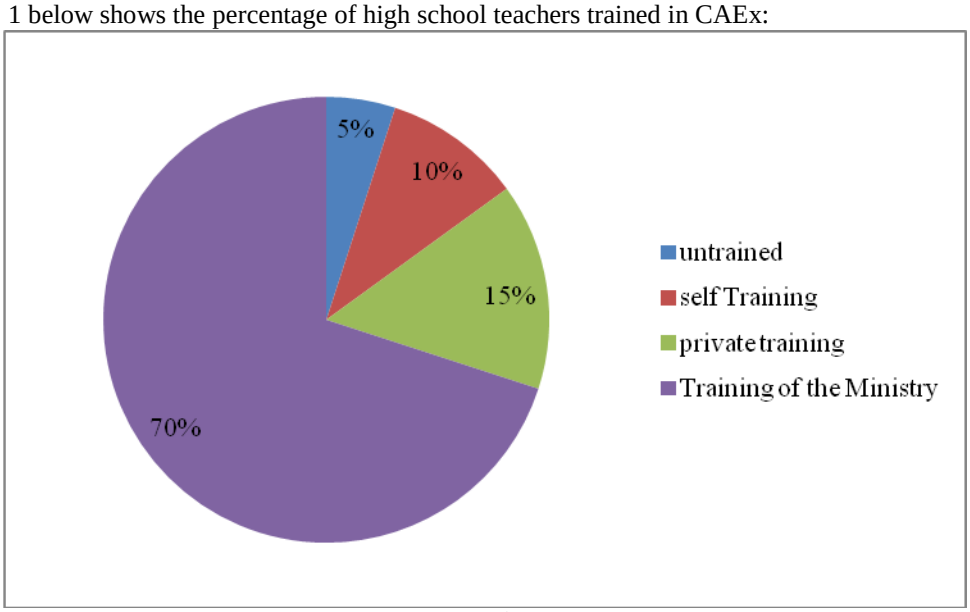

Figure 1 :Training of teachers CAEx

According to Figure.1, we note that 70% of teachers have received training from the Department, while only 5% had not received training in the use of CAEx.
For Question 8: Does the CAEx is used in the classroom?
The figure. 2 shows the percentages of teachers in our sample users and non users CAEx

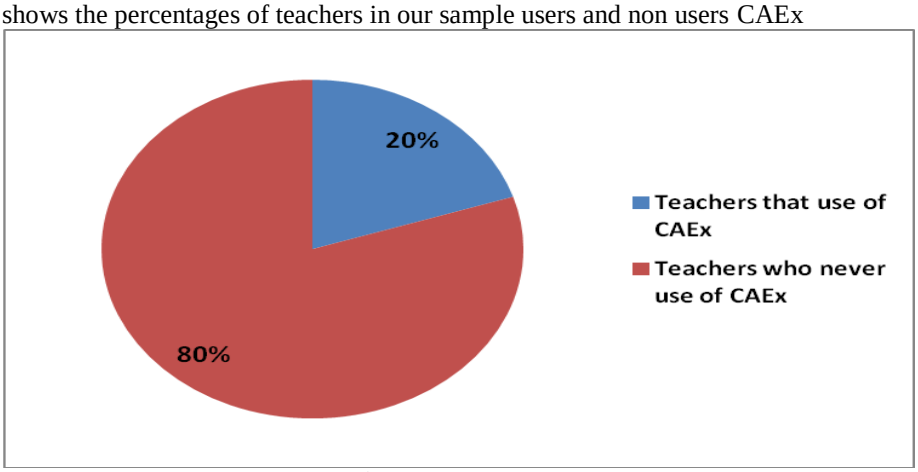

Figure 2: Percentages of teachers non-users and teachers users CAEx

Analysis of the results shows that teachers users CAEx class does not exceed 20% although all facilities are equipped CAEx.
For questions 9 and 10: What are the sensors used in the classroom and what experience are they used?

The interviewed teachers and questionnaires show that with the Logger Pro software and LabQuest interface compatible Varnier most popular sensors are sensors:

• voltage sensor
• electric current sensor
• pH sensor
• conductivity sensor
• pressure sensor

For question 11: What are the advantages of using the CAEx?

For that matter, it was necessary to choose between ten choices available:

the CAEx

1-allows saving time;
2-corrects representations of learners;
3-Strengthens group dynamics for learners;
4-Develop the scientific approach in learners;
5-help learners understand better and faster;
6-Provides more accurate values;
7-Participates in the development of learners' capacities in the field of ICT;
8-Allows the teacher to make less effort to achieve its objectives;
9-Helps to better assimilation of concepts among learners;
10-Contributes to a better acquisition among learners.

The figure.3 represents the percentages of previous choices

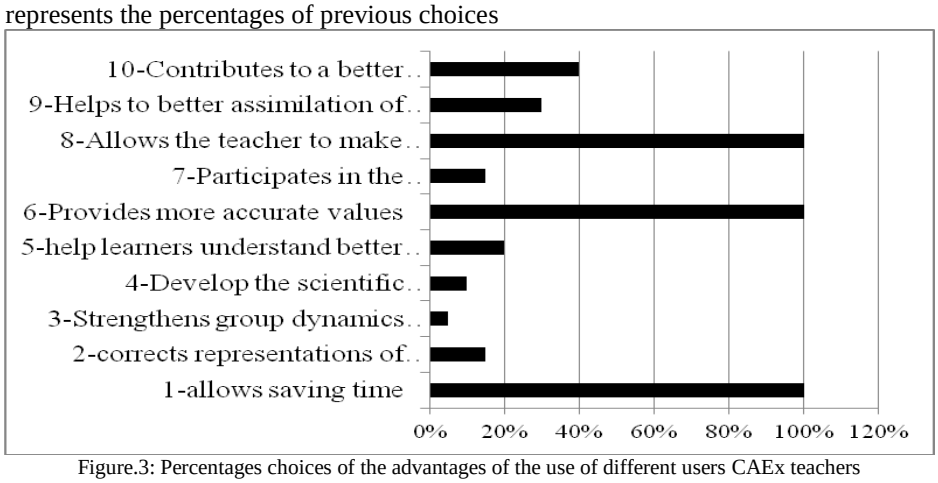

Figure.3: Percentages choices of the advantages of the use of different users CAEx teachers

For choice 1,6 and 8: The results showed that 100% of the teachers surveyed, claim that the main advantages of the use of CAEx are:

- CAEx allows saving time, indeed, CAEx processes the data and quickly turns the algebraic value to a digital value and draw the corresponding curves instantly. The teacher buys time allowing it to then interpret these curves. It can also save and then open the file again in class very quickly. The time saved can then be used later to interpret the results.
- CAEx the present values and more accurate results, eg pH measurement of a solution: the classic pH meter does not give exact measurements, unlike the pH meter sensor that allows us a calibration have more accurate measurements.
- The CAEx allows the teacher to make less effort to achieve its objectives, in fact, the teacher saves time because it is the software that processes the data and draw the curves which facilitates its work during the session courses.

For choice: the results show that with a too small percentage of the order of 5%, the CAEx does not contribute to group work because it is the teacher who makes the TP given that there is a single sensor for a given experiment, because the equipment is expensive.

For question 12: which do you prefer: classic experiment or experience with CAEx?

60% of respondents prefer computer-aided experimentation with classic experiment saw the benefits that the CAEx tool to the teacher;

For question 13: What are the advantages and disadvantages of using the CAEx this question was an open question to leave the choice to the teacher benefits or potential disadvantages?.

Among the advantages of the use of CAEx found in this issue, we identified:

-Gain time
- Provides more accurate results

-Allows The teacher to make less effort to achieve the purpose of the experiment
-Ability To study very fast phenomena
The disadvantages of the use of CAEx identified in our survey are:
- The students Does not develop the analytical skills and do not draw the graphs so it loses capacity with this new tool.
-The students do not face the measurement errors.

4. Conclusion:

We conducted a survey by questionnaire and interview with teachers of physics from several high schools and among the CRMEF trainee teachers.
The results of our survey show that the CAEx is a tool still little used in Moroccan schools. The reasons are for some a lack of training in this tool and for others a lack of time to perform the experiments. Despite the training and efforts by the Ministry, the objectives are still far from being realized. However, the student teachers are enthusiastic about using this tool in the sessions of teaching, we must give more attention to this new generation that can improve the level of education in Morocco, and seamlessly integrate technology in education.
Certainly the use of CAEx is convenient, but it also has disadvantages like any teaching tool. According to our survey, disadvantages are that the student does not handle and does not draw graphs itself. But these advantages are that it allows the teacher saves time later to interpret results and to make other experiences of CAEx has values and more accurate results and allows the teacher to less effort to achieve his goals, so there are advantages especially with proper use of the tool during the session.
We wish use of CAEx in class and to measure its contributions to students to see how it contributes to a better assimilation of concepts among learners.

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