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## **COMPUTER TRAINING IN CHEMISTRY: STRENGTHS AND WEAKNESSES**

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### ■ **Abstract:**

*Chemistry, as a subject of study, can not be taken into consideration without the computer science, especially nowadays. The issue of using computer in education has been deeply and multilateral researched in many countries, and the proposed solutions were determined, on the one hand, by the stage of education within that country, and, on the other hand, by the computerization degree of the society. Within the information society, the use of information and communication technologies in the educational system becomes a necessity. Interest in studying Chemical elements with the help of computer is determined by a number of cases to be presented in this paper.*

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### ■ **Keywords:**

*chemistry, computer assisted learning, method of training, educational software, computer and software integration in school, AeL software platform, SIVECO Romania*

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### ■ **TEORETICAL CONSIDERATIONS**

*Computer assisted learning, as a method of training, has a major function in increasing the effectiveness of educational training process. Computer assisted training as a method of learning-assessment certainly contributes to changing the educational curriculum. It was established that the computer and its facilities are still little explored within the educational system in Romania. The computer, in this case, is used as a means of education which runs educational programs and thus assists the teacher in the act of teaching, formative and summative assessment and the student in learning and assessment process. It is obvious that technology continues to develop rapidly suggesting new possibilities to all sectors hence education also.*

*Attraction for educational software consists in competitiveness, dynamic design, user initiative, program documentation and flexibility to adapt. Computer and software integration in school*

*and thus in the educational process is a necessity dictated by current requirements. The accomplishment of educational programs is not an aim in itself. They are edited to be applied in teaching activities conducted by educators and educated.*

*The information era consists of three periods: the information society, knowledge society and awareness society. Increased IT knowledge among teachers and students is an important step towards the information society.*

*Currently, the AeL software platform developed by SIVECO Romania is being used; it is based on a learning situation that reevaluates the opportunity to present educational materials as new, dynamic, interactive methods, induced by computer use and it presents a number of benefits directed to the favorable attitude of the student to study.*

*New information technologies should be considered as a means of teaching (integrated in teaching various subjects, including Chemistry)*

with important role in improving the quality of teaching and improving the educational process.

Patterns to use Computer Assisted Training in the education process were traditionally the same: setting and controlling knowledge, modeling and visualization of processes and phenomena in explaining the new materials, texts processing, development of logical thinking, individual shaping of processes by students.

It was established that the number and intensity of research on Computer Assisted Instruction in various countries is directly proportional to the degree of computerization of the educational process and the readiness of teachers to apply the computer in teaching Chemistry. Despite research that addresses a deeper or more superficial extent, the problem of computer use in studying chemistry, remains a less explored area.

Chemistry, and other related disciplines (Physics, Mathematics, Biology) has also benefited from the e-Learning applications, the new perspectives that the computer and the Internet bring in the training process. Learning Chemistry through another method, Computer Assisted Training, is a challenge and a "something else" in the same time, and combining them with other methods of teaching-learning is a necessity.

Computer assisted learning involves two important aspects:

- ✚ Developing a training program, which is the result of educational programming, thus an educational product;
- ✚ Transcription of this program in the computer program, which is an informatics product.

Teachers who want to use the project method in class are forced to adopt new educational strategies to get results. Direct education methods that rely on manuals, presentations and traditional assessments do not work too well in an open learning process, interdisciplinary, that describes the project-based learning.

Most teachers are not prepared to assume themselves the role of guide or facilitator and to teach this way. Those who make the transition to project-based instruction are facing some challenges to be overcome by the use of new teaching methods. As teachers and students

work together on projects and integrate technologies, their roles change, and the educational space rearranges its performers.

The projects require a change in the role of teacher. Teachers who are familiar with the exposures and rely on existing textbooks or materials may have difficulties in switching to a learner-centered approach. This means to waive the unidirectional control allowing students to work in multiple directions, in different activities in the same time. While the planning phase of the project requires more time to prepare, once the project is started, the teacher acts as a coach or facilitator. For teachers, this is interesting and it is a method to approach to individual styles and creativity of students.

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### ■ EDUCATIONAL SOFTWARE IN CHEMISTRY

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Educational software is the name of a program designed in relation to a series of teaching coordinates (behavioral objectives, specific content) and technical coordinates (providing individualized interaction, the feedback sequence and formative assessment); broadly an educational software is any program designed for use in training and learning.

Educational software in Chemistry is intended for students, or any person interested in this area. This software is designed to attract users by allowing them to conduct chemical experiments lacking the specific materials. With 3D models learners can see how chemicals look like, how certain reactions take place and may view certain phenomena which can not be visible virtually.

The various examples presented by SIVECO refer to studying periodic system of elements, isotopes and nuclear reactions, the reactions equations stoichiometry and analytical methods of quantitative and qualitative ions in solutions. By using the simulation models the time needed to assimilate concepts and specific concepts of analysis is to be shortened and operating costs of each method are to be minimal. Furthermore, the large number of possibilities and parameters of the software used can give their users the flexibility needed to acquire a correct analysis on samples with unknown compositions and concentrations. Without replacing the direct contact with chemical substances and equipment, the works on computer enrich the possibilities of acquiring knowledge and actively

implementing them. By using computer the learning potential is huge. The computer provides students and teachers "the opening" to the world, to the others. He gives the student the way to overcome isolation. For teacher and student altogether, the computer represents a great help during classes and elsewhere.

Weaknesses for computer use:

- ✚ it affects the child's posture;
- ✚ it enlarges diopters;
- ✚ it determines aggressive behavior due to games;
- ✚ it allows the child to relate to unknown persons.

Strengths for computer use:

- ✚ the child learns to control an instrument by playing;
- ✚ it improves hand eye coordination;
- ✚ it speeds up the reaction;
- ✚ it offers the opportunity to explore the world and create original work;
- ✚ it facilitates the interpersonal relationships;
- ✚ the child gets a good opinion of himself;
- ✚ it improves his school performances.

To students, the computer has only strengths.

The interactive software has a strategy that allows feedback and ongoing monitoring, resulting in an individualization of course depending on the subject's knowledge.

Following the analysis we did to achieve this work, we can say that the main features of computer assisted instruction are:

- ✚ ensure unity among the functions of communication, storage and control, resulting in improved learning by feedback effect;
- ✚ exempt professor from teaching a series of acts of routine (teaching, repetition, evaluation, etc.), thus giving him the opportunity to focus his efforts and time to refine studied material (by steps and investigation);
- ✚ require combining the study by reading the manual or the computer with other bibliographic materials and experiment
- ✚ require maintaining the relationship "teacher-student" working in groups or with the whole class to confront the results, to create that climate, develop a sense of community;
- ✚ provide an active reception of knowledge, depending on students working at their own pace;

- ✚ teach students self-control and management of their intellectual activities

- ✚ create the possibility to revise the poorly understood problems and thus to make a conscious approach to knowledge.

The educational software designed for simulations and virtual experiments to teach chemistry lessons has the following advantages:

- ✚ allows teachers and students to create fast, easy and secure virtual experiments needed to understand certain phenomena;
- ✚ there are no actually consumed substances, no broken utensils, no materials, which are usually very expensive;
- ✚ there is no toxic working environment as in a chemistry laboratory;
- ✚ accidents are eliminated when conducting highly dangerous experiments;
- ✚ virtual experiments can be achieved in a much shorter time, thus saving time;
- ✚ virtual experiment to determine the chemical nature of a solution can successfully replace the real experiment when it does not exist in the laboratory.

The use of AeL platform and its own programs lead to a teaching-learning process more efficient and attractive to students and teachers.

The use of computer in teaching Chemistry has both advantages and disadvantages:

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#### ■ ADVANTAGES

- ✚ the use of computer provides a high degree of individualization and independence of learning, ensuring the reverse learning link
- ✚ through feedback, the amount of acquired knowledge is being increased
- ✚ computer assisted learning provides a self-paced learning
- ✚ it ensures a conscious knowledge acquirement
- ✚ it sequences the scientific content
- ✚ it facilitates the ongoing evaluation of results

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#### ■ DISADVANTAGES

- ✚ the poor endowment with computers leads to the fact that students can not work simultaneously, moreover, not all students have the same skill in computer use
- ✚ a depersonalization of teaching-learning act
- ✚ excessive individualization of learning can lead to denial of student-teacher dialogue

- ✚ due to content sequencing, the students may not have the representation of the phenomenon
- ✚ when using the directed learning, the student may not express his spirit of independence and creativity

### CONCLUSIONS

We like to believe that the time we used the laboratory only for experiments has gone, that there is no longer that exasperation of students forced to do well with little. But this is not completely true.

In most schools in the country the activity takes place in chemistry laboratories, in case that they exist or are still functional. This is where the virtual education with its computers and programs comes into discussion. An instauration of educational system has taken place.

When designing software to perform a range of experiments, there should be as many parameters as possible to study physical phenomena. Thus the teacher can approach different work strategies in the class according to the performances he wants to achieve.

The real laboratory should not be removed from the process of training. The twotypes of experiments should complement each other. By using computer applications, an ideal working space is being created and human errors inherent in real experiments are being eliminated.

The main reasons for which we consider interactive virtual experiment useful, would be related to the assessment of rigorous scientific content by the students and to the development of investigative capacity, creativity, modeling, analysis, interpretation, generalization, and confirmation of studied phenomena.

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