

Modern Perspectives of Using the Computer in Teaching Physics

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Abstract

Using a computer in class has significantly increased the effectiveness of the teaching process. It has also motivated students more highly to study as it has made their learning process become personalized and has also developed the relationships among those involved in the process. The Internet has made it even easier by offering electronic platforms, virtual libraries, wikis, blogs, glogs etc, all containing varied well-structured information, presented in an attractive form. Using the computer has also made possible to virtually re-create phenomena and to make virtual experiments - these are but a few of the great advantages of using the computer in teaching Physics that are presented in this paper.

Keywords: *electronic learning; multimedia; electronic platforms.*

ACM/AMS Classification: k.3.1

1. INTRODUCTION

The rhythm of changes is faster as days go by. The new technologies change the way we think, we work, we have fun and relate to the others. The Internet has become the most powerful means of communication that has ever been created. (Robinson, 2011).

The evolution of teaching theories has led to the improvement of the learning environment in order to develop the students' superior thinking abilities as stated in Bloom's taxonomy, as well as their critical thinking and creativity. The role of the teacher and that of the student have changed. Teachers were able to overcome the barriers set by traditional teaching by integrating the new information and communications technology (ICT) in the teaching/learning process so as to improve students' achievements.

A series of advantages of using ICT allowed the creating of some more profound and motivating learning environments, which made technology to be considered an active partner in the process of encouraging and facilitating thinking and accumulating knowledge. We only mention here a couple of these advantages:

- ICT allows the access to a greater amount of information in an easier way;
- ICT offers the opportunity of means such as text processing or drawing, much better than the usual ones;
- ICT expands the types of construction kits that can be used in the classroom;
- ICT offers a flexible resource system that can be used to observe and explore some complex phenomena, which can not be otherwise be achieved in a regular classroom.

Using technology is effective when it can offer support for building up knowledge, exploring, learning by doing, by conversing or by reflecting. (Jonassen et al, 1999).

The key element of the information and communication technology is the computer. When used in teaching, this device does a lot of things that may help education become more successful: a computer facilitates the access to information, yet does not replace the actual teaching; it helps this process so that it can become better and is also a means for an interactive presentation of new information. Moreover, the computer has become the third element involved un the teaching/learning/assessing process, along with the teacher and the student. However, what is extremely important is that students learn *with* and not *from* a computer. (Cerghit, 2008)

CAI (computer assisted instruction) represents a way of teaching using the computer which is highly individual, interactive and guided.. In a larger sense, CAI represents any way of using the computer within the teaching/learning/assessing process. The most widely used instruments are practical exercises and tutorials, yet for sciences simulations are of extreme importance, as well as a laboratory assisted by a microcomputer and problem-solving. They all lead to developing the students' superior thinking abilities as they are stated in Blooms taxonomy. (Adăscăliței, 2007)

Introducing CAI in the teaching/learning/assessing process of Sciences, especially Physics, is becoming mandatory as there is a decreasing number of students who choose to study this subject, which might be caused, according to studies, by their losing their interest and motivation. Therefore, it is our opinion that Science curricula should be re-thought so as the teaching methods should promote conceptual understanding through an interactive involvement of the students in both *heads-on* and *hands-on* activities that offer immediate feed-back through discussions with classmates and/or the teacher. Moreover, rapid progress in sciences and technology require new objectives for Science classes. Students get to learn about complex phenomena in Physics and sophisticated devices through the Internet so they will need critical abilities and a good technique of assessing the complex information they are supposed to deal with. (Esquembre, 2002)

The new technologies must be made part of this teaching/learning process of Sciences, especially of Physics, so as this can be effective. In order

to achieve this, technology must be introduced in accordance with the actual content of the specific science and also correlated with a proper pedagogy. Moreover, the technology-based teaching in science must make the most of its unique features, making scientific researches more accessible and also develop the students' understanding of the relationship between technology and science. (Flick and Bell, 2004) In this way, these principles suggest that those teaching/learning/assessing methods in which new technologies are integrated must allow students to take the step from *knowing* to *doing*.

The main forms of the information and communication technology that are considered as being relevant in the teaching/learning process of sciences are as follows: instruments for acquiring, processing and interpreting data; multimedia software to simulate processes and carry on virtual experiments; informational systems, internet, intranet; editing and presentation instruments; projecting computer technology. (Osborne and Henessy, 2003)

2. USING THE COMPUTER IN TEACHING PHYSICS

Firstly, the developing of the solid state Physics, especially semiconductors, made possible the invention and development of the computer. Not more than a decade ago, the computer was used in Physics classes to do text editing (articles for magazines in Microsoft Word), to present papers, lessons in Microsoft PowerPoint, doing calculations, processing experimental data and drawing charts in Microsoft Excel or creating/managing or interrogating databases in Microsoft Access. (Nițescu et al, 2001) Nowadays, the virtual character of education leads to a decentralization of the multiple information and knowledge bases.

The Internet has become the most powerful network of communication, being an active medium with multiple possibilities of being used:

- it stores, process and offers varied information to its user;
- it allows interactions between the ideas, experiences and competences of the users who logged into the network;
- it facilitates communication among students and between students and teachers;
- its a medium for the distribution of the curriculum materials necessary in the teaching process;
- it helps making the traditional teaching activities more original, being done face-to-face. (Bocoș, 2013)

All the facilities the Internet offers (electronic platforms, virtual libraries, wiki's, blogs and glogs), the varied information, well structured and attractively presented, re-creating phenomena and making virtual experiments are a few of the advantages of using the computer in the teaching Physics process which have made it interesting again for the students.

Further on, we will present those facilities used in teaching/learning Physics which made good use of the students creative abilities (glogs), facilitated collaboration and effective communication between students and teacher and student to student (glogs), as well as those which facilitated learning by offering access to information and learning guidance (Claroline electronic platform) and to a superior knowledge, unavailable through traditional methods (virtual experiments).

2.1 Glogs

Glogster is a fun and innovative tool for creating collage-style multimedia posters and allows users to interact with content. Digital posters (glogs) go beyond standard presentation mediums such as paper posters or PowerPoint. Glogster allows teachers and students to share knowledge with others while expressing their creativity. The benefits of electronic posters are excellent: colour, movies, animation, sound and true interactivity are now possible; the presentation can be archived and made available on the Internet; easy searching for particular topics of interest during the limited time at the conference is easy; expensive and often time-consuming printing in large formats is no longer needed. (<http://www.glogster.com>)

The use of multimedia platforms while studying Physics creates the conditions for obtaining school success by reaching the motivational optimum required for each sequence of the learning process. The presentation of multimedia content should exclude extraneous and redundant information. Multimedia learning is more effective when:

- it is interactive and under the control of the learner;
- the learner is engaged with the presentation;
- the learners can apply their newly acquired knowledge and receive feedback.

Still, it is not the audio-visual message that has beneficial educative influences, but its integration in a learning-self-learning strategy done by the teacher. (Dinicã et al, 2012)

2.2 Blogs

The web logs are excellent communication tools for small teams or groups. The blogs give a space via the Internet where students share ideas and work together to express jointly their ideas. Benefits of learning with blog networks are learner autonomy, cooperative learning and time management. What makes blogs so attractive, in both the educational community and the Internet at large, is their ease of use. In the teachers' and students' hands, blogs become

something more again. The web is by now a familiar piece of the educational landscape, and for those sites where personal publishing or chronologically organized content would be useful, blogs have stepped to the fore. (Downes, 2004)

Teachers can use blogs in order to increase the communication level among the participants at the course, as well as the level of their participation and the depth of engagement. (Fessakis et al, 2008)

The students preferred this way of presenting their whole activity because they can continue working in a team outside school, without being restricted by the formal environment inside the Physics laboratory and they have the opportunity to explore the virtual space for what they are really interested in. (Dinicã et al, 2012)

The advantages offered by using blogs as a non-formal learning environment cannot be exploited within the formal environment, but by a responsible involvement of the teachers and by a remarkable psychopedagogical training which should allow them identify and capitalize for their students as many capacities and competences as possible, regardless of the environment students activate in. (Singer and Sâmihãian, 2009)

2.3 E-learning platform Claroline

E-learning platforms are software that organize and automate many of the activities associated with e-learning. They are applications used for delivery of learning content and facilitation of learning process. E-learning offers new opportunities for both educators and learners to enrich their teaching and learning experiences, through virtual environments that support not just the delivery but also the exploration and application of information and the promotion of new knowledge (Holmes and Gardner, 2006).

A particularity of the teaching-learning-assessing Physics consists in the fact that during this activity the basic thinking operations are formed and developed on a wider scale than at other subjects. (Malinovschi, 2003) In this context, if it is desired that the student should acquire knowledge, competences, behaviour and attitudes accordingly to the objectives, it becomes absolutely necessary to find some complementary methods and means that could facilitate his acquisition.

The way we have chosen to compensate the insufficient number of hours allocated to Physics was through a site (www.dinescu.info). This does not substitute the traditional class, but it helps students to fathom, systematize and set their knowledge and competences outside classes, in their own time and rhythm. We have decided on this solution because it ensures an increased autonomy, the content of the materials being in accord with the target students' level, study profile and interests. (Dinescu et al, 2010)

The accessing of the educational content can be done through the Claroline e-learning platform, due to some considerations: it is easy to install and administrate; it can be used whether for the teacher-conducted or the individual study. The Claroline platform is organized around the concept of spaces

related to a course or a pedagogical activity. Each space provides a list of tools that enable to create learning contents, manage training activities and interact with the students (<http://www.claroline.net>)

The accessing of the educational content by the use of the e-Learning platform presented, confirms that e-learning method enables the introduction of the new education formula, which may include advantages of traditional teaching and distance education. Also, students consider this form of learning far more interesting and accessible, according to their learning style and it ensures the access to the materials exactly when and where it is necessary.

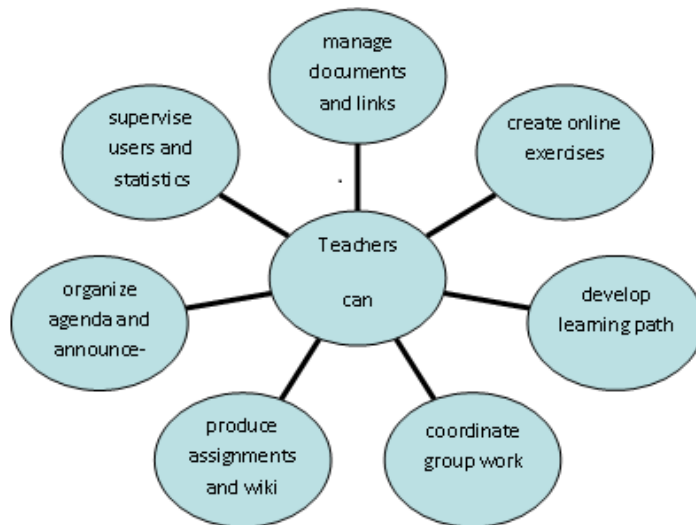


Figure 1. The facilities of use an Claroline platform for teaching Physics

The disadvantages of use an e-learning platform for teaching Physics are:

- it requires that teachers should have experience in planning their own didactic materials and making them accessible to the students, and the latter should also be experienced in accessing and using those materials;
- implies costs that might be very high and teachers or schools cannot always afford them;
- planning the materials and the tutoring with everything that it involves are great time-consuming activities for the teachers.

2.4 Virtual experiments

The fast progress in science and technology requires establishing new objectives for the science classes. Students learn about complex physical phenomena and sophisticated gadgets through the Internet. The new learning

technologies, including the information and communication one, together with the resources offered by the Internet allow the alignment of the courses to the evolution of science. An important role in Physics is played by the simulations or virtual experiments. Experimenting is the distinctive feature of sciences, which fundamentals knowledge and scientific understanding. The real or virtual experiments match the type of learning promoted by these since they encourage the discovery learning or inquiry-based learning (Finkelstein, 2006).

Virtual experiments or simulations can substitute a real experiment when the phenomena cannot be investigated or observed in reality, the laboratory equipment is complicated, expensive and inaccessible or there is a danger for the real laboratory environment. Further, the virtual experiments compared to the real ones have the advantage of having erased the space and time limits, offering the students a repeated and endless use (Li et al, 2011).

Simulation is a teaching method through which the teacher attempts at repeating, reproducing and imitating a real phenomenon or process. The students interact with the teaching software the same way and operator does with a real system, but the real situations are really simplified. As they get involved through experiences and experiments in solving some technical scientific problems, students have the chance to know directly the modern production process, technological methods and all the devices required.

Yet, it is still recommended not to totally replace the real experiments. When there are no objective limitations it is beneficial for the students to be involved in activities aiming direct confrontations with and investigations of phenomena. An optimal teaching-learning process can be accomplished by using them rationally and by combining proper instruments and resources. (Dinescu et al, 2013)

3. CONCLUSIONS

The opportunities given by the new informatics and communication techniques led to an increased interest for their use in education. Their introduction in school has a strong impact on the educational system. They open new perspectives for educational practices and contribute to their development. Because of working online, students have the chance to get involved in interactive approaches, unlike in the traditional class. The attractive way of presenting the information may ensure some extra motivation as far as the student is concerned.

However, an effective learning should combine traditional and modern methods, mixing effectiveness and the opportunities to socialize in the classroom (traditional teaching) with the opportunities of active learning offered by the online medium which has a superior technology.

Choosing a combined method for teaching/learning Physics makes us the beneficiaries of the advantages of traditional teaching (face-to-face lessons, lab sessions, guidance) while at the same time we can improve learning experiences through a series of online activities which can be done by students according to a previously settled schedule or in a more flexible way.

The new systems of connection and communication can accelerate communicational, imaginative and creative capacities, but can also slow them down or even stop them if they are inadequately used. The faster the student can produce ideas instead of just using them, the better the instrument is. No matter how effective the new technology might be, it has to be completed with traditional strategies of forming human abilities.

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