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Modern techniques of evaluation of the learning excellence

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Abstract

The author's intention is to point out ways of achieving learning excellence by usage of modern education means. This bold aim can be reached by using educational software and developing school projects within the teaching and evaluation processes.

Keywords: educational software, school projects, modern evaluation, excellence, e-learning.

The principles of modern teaching

There are a number of principles that must be taken into account when considering the teaching process:

- The principle of systematization of the didactical activity;
- The principle of accessibility of the didactical activity;
- The principle of active and aware participation of the students in the didactical activity;
- The principle of boiling down the results of the didactical activity;
- The principle of self-regulation;
- The principle of inter-correlation between conscious and sensorial knowledge (the abstract vs. specific alternative) [15].

The above principles have profound implications upon the teaching, evaluation, and didactical management processes, as well as upon the shaping of the teachers personality. First of all, these principles give the teachers some methodological suggestions regarding the didactical projects, the curricula design, the class management, and so on. Secondly, they provide a wide range of problems to be included in the initial and continued programs for shaping off the teachers.

Among the methodological suggestions regarding the teaching process, one may mention:

- The active involvement of the students in the teaching process, at their own suited pace and levels, most frequently by appealing to pair and small groups interactions;
- The pointing out of anchor-knowledge necessary in the teaching of new concepts, and the training of the students in conceptual and operational structures constructions;
- The embedding of positive and informative feedback into the teaching sequences, regarding the learning approach and achievement, the enhancing of drills and practical applications, and the diversification of the problems to be solved;
- The equal treatment of all the students, without any discrimination and prejudice, regarding their individual self-esteem and respect, their candid and systematic evaluation, their commitment toward the duties in the line of work, and so on;
- The establishing of a team-work and collaboration atmosphere, instead of a con-currential and rivalising one;
- The appeal to genuine tasks, meaningful for the real life and suited for various cultural groups, eliciting the students to operate with interdisciplinary information and bringing forth their progress capabilities;

- The inclusion of experiments promoting empathy, understanding and respect among students.

The objectives one has in mind when resorting to such suggestions are as follows:

- The nurture of a loftier intellectual spirit (adequate ways of improving one's knowledge and intellectual habits);
- The integration of the achieved knowledge and intellectual strategies into a derived general scientific frame;
- The development of one's creative abilities in an ethical sense;
- The nurture of a superior cognitive spirit regarding the employment and the interpretation of the achieved knowledge.

The achievement of these goals is monitored through the act of evaluation, a complex didactical process integrated in the teaching process as a whole and providing the recognition of the quality, level and effectiveness of the acquired knowledge at a given time. It provides also suggestions regarding the improvement of the teaching-learning process. The evaluation implies knowing the achievements and the evolution of the students throughout the whole teaching-learning process, at various moments in time. From the point of view of the implementation in the didactical activity, these various moments define three different evaluation strategies:

- Initial evaluation:
- Dynamical evaluation (evaluation during the didactical activity);
- Final evaluation.

Here we had in mind the evaluation through the following methods:

- E-learning;
- E-education;
- Advanced virtual environments.

Establishing one's own action plans

Our own practical experience led us to developing the following lines of action:

- School projects;
- Collaborations with R&D institutions;
- Establishing of a Center for Excellence within the Tudor Vianu National College for Computer Science.

The involvement of the latter in the way towards excellence consists in the authoring of educational software by the teachers and students of our school. The many programs have as a starting point various didactical scenarios, which identify and describe in detail the content of every lesson moment, pointing out the suited learning items and implementing the operational objectives of the specific lesson. The suited learning items for attaining the operational objectives are those who:

- address specific learning difficulties arising from the traditional teaching of the concepts;
- facilitate the understanding of the meaning of the terms;
- elicit and keep wide awake the students interest.

The advantages of educational software usage

There are a number of clear advantages that come up when using educational software as opposed to the traditional teaching methods. Some of these are:

- User-friendly working environment;
- The possibility of either individual or team work, for best results;
- The stimulation of the creativity and competition spirit of each student, by covering different modules, suited for them;
- Visual support, conveying a fast understanding of even the more delicate and complex scientific themes;
- Unconventional test, allowing for an optimal feedback;

- Animation and replay, for a more intense involvement of each student into the learning process;
- The possibility for the student of learning while playing, by varying different parameters and quantities in a rigorous, mathematical way;
- The possibility of permanent upgrade of the operating system.

An example of educational software of our own making

Fascinated by the way in which the measurements depend on the speed of the reference frame, we created this software, for a better understanding of these amazing phenomena. It is a series of interactive lessons that show very interesting aspects that derive from the Special Relativity Theory, which can be used in class or in individual study.

Figure 1: The front page of our software.

Each lesson is divided into three sections:

- Learn: displays the Physical laws that explain the specific experiment; it contains mathematical explanations and definitions for all the concepts involved in that lesson. [1]
- Play: instantiates the theory by enabling the user to play and discover the phenomenon behind the mathematical laws.
- Test: contains single-choice questions based on the concepts presented in that lesson.

The first lesson presents the most interesting effects that occur at high speeds (comparable with the speed of light), according to Einstein's Special Relativity Theory. These effects are: the contraction of lengths and the time dilation. The lesson's sections enable the student to fully understand the phenomena by learning, playing and testing his knowledge. [12]

Figure 2: Stretching durations as visualized in our software.

The Play section shows length and time information for the experiment as the student selects different shuttle speeds. It also presents an animation of the high speed's effects.

The second lesson presents the effects that occur at high speeds (comparable with the speed of light), on geometric figures. At high speeds, according to Einstein's Special Relativity Theory, a length contraction occurs, on the direction of movement. The lesson's sections enable the student to fully understand the phenomena by learning, playing and testing his knowledge.

Figure 3: Relativistic effects exerted upon geometric shapes.

The Play section enables the student to see the effects exerted on a cube or a sphere at different speeds. The animation makes it easy to understand and visualize the phenomena.

The third lesson presents the effects that occur at high speeds (comparable with the speed of light), in particle accelerators. By accelerating particles at speeds close to the speed of light, their mass increases, this resulting in an increase of their trajectory radius. The lesson's sections enable the student to fully understand the phenomena by learning, playing and testing his knowledge. [11]

Figure 4: Elementary particles in an accelerator.

The Play section enables the student to select different speeds for the particle and the animation makes it easy to understand and visualize the effects on mass and trajectory.

The forth lesson presents the light cone concept and, as an exemplification, the Sun's death. Einstein's Special Relativity Theory states that two individual events are separated by quadriintervals, which are represented by a light cone. The lesson's sections enable the student to fully understand the phenomena by learning, playing and testing his knowledge.

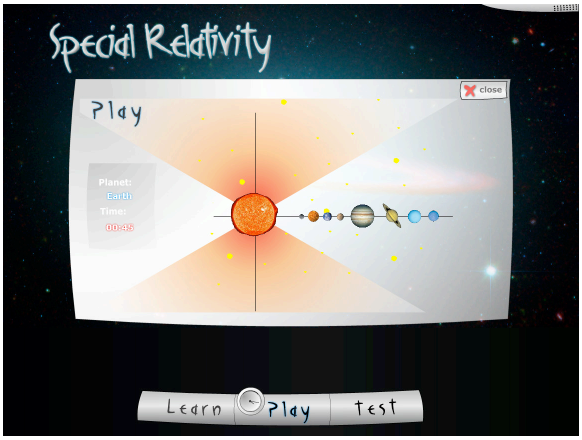

Figure 5: Light cones and the Sun's death.

The Play section enables the student see, by selecting each planet of the solar system, the time it takes to witness the Sun's death (the time it takes to enter its light cone). [4]

The last lesson of the project presents "the Martian's paradox". We know from the previous lessons that the duration of a process depends on the speed of the reference frame. This means that an event from a series happens sooner or later, depending on the speed of the watcher. The lesson's sections enable the student to fully understand the phenomena by learning, playing and testing his knowledge.

Figure 6: A Martian dinner.

The Play section enables the student to see a moment from a series of events, traveling with different relative speeds. Although the Martian is convinced that he is eating, you may see he's not!

Conclusions

The traditional teaching methods cannot deal appropriately with the avalanche of new knowledge and with the accentuated dispersion of the activity domains and jobs. Paradoxically, the qualifications become more and more specialized, while getting at the same time more and more interconnected. The new IT and communications technologies in the society come to rescue the education process.

We wanted to test the impact that the usage of this software has on our students. We invited them to try it and then we asked them to complete a questionnaire. Here are some results.

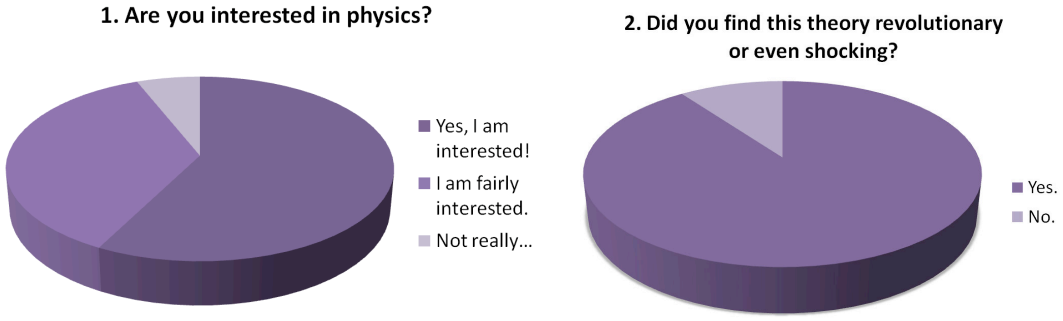

Figure 7: A set of findings regarding the students using educational software of our own making.

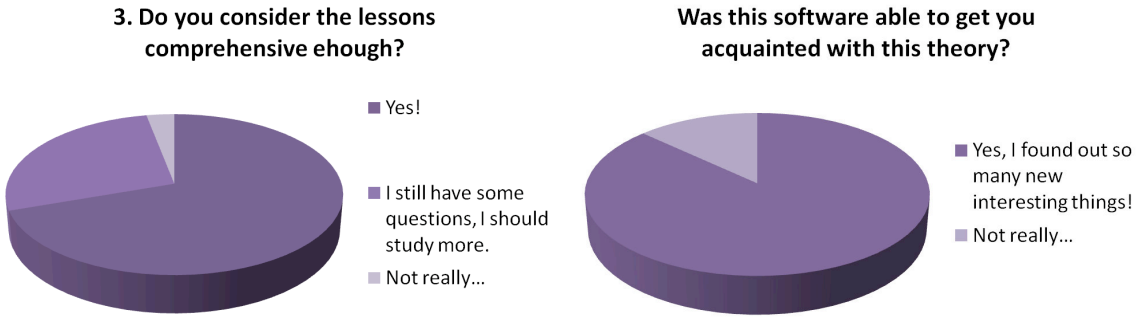

Figure 7 (cont.): A set of findings regarding the students using educational software of our own making.

We are not pleading here for a rebuttal of the traditional teaching methods, especially in the first years of school when the personal touch of the educator remains of most importance, but we strongly believe that the usage of modern technologies and educational software is a must of the education process, appealing to the individual character of each student. The modernity of learning through school projects and IT consists in the diversity of contexts in which the teaching activities take place, in the acquiring and exercise of new abilities, and in the shaping and strengthening of students' spirit.

Throughout the making of a number of somehow more informal school projects involving astronomy, computer graphics, physics, photographic art, and so on, we did observe that the students learned to better communicate with each other, to work within a team, and to take responsibilities. We got also aware of the competition spirit manifested by them as a consequence during subject contests and scientific communiqués meetings.

Some of these projects gave our students the opportunity to get in touch with other teenagers from various towns and/or countries. As a side effect, we also noticed their increased care for a cleaner, pollution free environment.

And, of course, they got new and thorough knowledge in a non traditional, more involving way. Please feel free to visit our dedicated websites:

- http://www.lbi.ro/lightpollution
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