Original Research Article

From hypotheses and working scenarios to arguments aimed at alternating traditional training with computer-assisted training

ABSTRACT

Nowadays, the era that we live in can be described as the Information Age, sometimes even as the Knowledge Age. No matter what area of science and technology we look at, it is obvious that we are dealing with an 'information overflow' without precedent in the history of mankind. In this context, Educational Sciences are no exception, and recent advances in this field, considering Computer-Aided Training, would have been unthinkable, unmanageable, and unattainable without the support offered by modern information and communication technologies, in the sense of Learning Management Systems. In its turn, Computer-Aided Training via sustainability educational index is integrated into Knowledge Society, where it plays an important role, for educational data-dependent actors, in decision-making, problem-solving, analyzing trends, understanding their customers, and doing research, being closely linked with pedagogical requirements in decades. Through this paper we aim to show that, at the moment, it is appropriate not to rely only on classical training, or on the contrary to deviate too much from it, embracing only computer-assisted training. It is appropriate to be flexible and to choose to carry out the pedagogical act using both variants equally, by alternating them in a modular aspect.

Keywords: educational perspectives, e-learning, electronic portfolio, Knowledge Society.

1. INTRODUCTION

Today, at the end of 2020, we notice that in pre-university education, but also university education alike, computer-assisted training has started to gain and gain more and more ground. Initially seen only as simple means of information-documentation, both for teachers and pupils/students, information and communication technologies penetrate deeper and deeper into the school and academic environment [1], representing a real facilitator of configuration, design, and organization. lessons, learning control, as well as an effective means of assessing and obtaining feedback [1],[2]. Moreover, through information and communication technologies it is possible to make the transition, very easily, from content-centered learning to a learning-centered on the individuality of the student, in the sense that he can learn at his own pace, planning -and time alone (at will), respectively identifying their resources and implicitly the limits.

At the same time, the children, as the case may be, the student, develops his skills and abilities to use the computer, and applies in practice, willingly or unwillingly, through

exercises and proposed topics (somewhat more numerous with the pandemic), the acquired information, passing - there is thus a form of education that has in the foreground the formation and only in the background its information. Most of the scientific elements regarding the forms of education are observations and routine records, contained in research reports, and briefs, each having its own importance within the intimate mechanism of the computer activity [3].

Thus, through the computer, the triad of educational objectives is effectively reversed, with the formation of attitudes on the first plane, followed by the formation of skills and habits, the transmission of information remaining on the last plane. Obviously (in our opinion even unhappy), in classical education this reversal of the triad of educational objectives is attempted, but there we are still cantoned, such as the long crystallized deposits or the population of other societies (see Fig. 1) - in the massive transmission of information (due to the facilities offered by the new information and communication technologies) [4], in full agreement with curricula, even if they are not reflected in the current requirements of society or economical demands [5],[6].

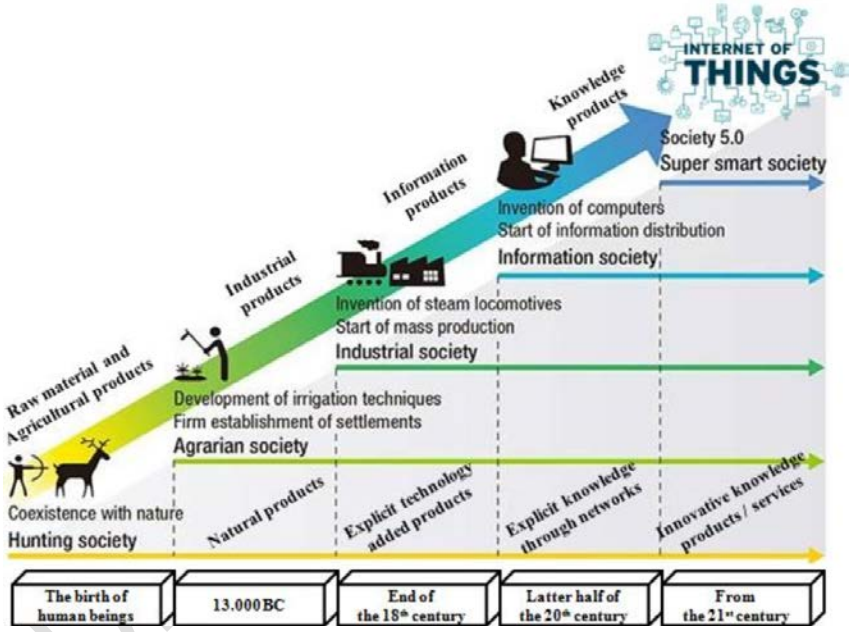

Fig. 1. Evolution of societies from the Hunting Society to Super Smart Society [6]

However, this does not mean that curricula are abandoned during computer-based classes, but that, with the information available, it is much easier to form attitudes, skills, and abilities through e-learning. Under these conditions we would be tempted to believe that man, in this case, the instructor can be easily replaced by a computer or other similar devices. This idea can be vehemently denied by the argument that the efficiency of this machine, at least in the current conditions dictated by the course of society, depends on human skill and creativity.

The teacher is and will remain, for a long time, the one who outlines, defines, and proposes ways of organizing content, learning activities, tests, and ways of evaluation, the computer being only a useful means to make his work easier. If a teacher does not know how to use a computer effectively, it will not prove useful; but in no way is the role of the teacher minimized or canceled, but only changed beneficially. Thus, the teacher, beyond the huge range of information he comes in contact with (Fig. 2), assumes that he can manage his time

more efficiently and that he can transpose, sometimes even transform, into a person who monitors, analyzes, and evaluates the individual learning process.

Fig. 2. A mind-map example for the massive transmission of information related to the Big Data concept [7]

Beyond the traditional criticisms brought to the development of e-learning in education (minimizing teacher-student / student communication, respectively student-learner, slowing down the development of student creativity, limiting interactions, etc.), the introduction of ICT in education contributes decisively to the modernization of the educational system. This was highlighted, in Romania, since the 80's by Professor George Văideanu, who illustrated in a remarkable paper the benefits of the computer:

- provides information organized according to the programs or according to the requests of the assisted one (in this case, it works like a perfectly organized library);
- questions the learner and thus identifies the gaps;
- corrects mistakes and eliminates gaps by providing relevant information;
- systematically controls the knowledge and supports the self-assessment efforts of the learner (the computer works on the same principles as a meditator);
- performs actions to recapitulate some themes, modules, or disciplines, and, besides, offers exercises to stimulate creativity, starting from a working template predefined by the teacher.

Starting from these aspects, through this paper, we want to show that computer-assisted training is not just a spontaneous reflection of the educational process, but especially a benefit of society in the current conditions dictated by the economy and by the pandemic. We also want to emphasize the convenience of carrying out the educational activities in this form, without enrolling as followers of computer-assisted training with traditional training.

2. MATERIAL AND METHODS

This paper started from the idea of highlighting computer-assisted training, which was in a certain period perceived as an unnecessary discipline. And this in the conditions in which the students, from the last 5-10 years, came to the wrong conclusion, that they would no longer need such a discipline, because they were born and raised with the computer. Such a wrong finding overshadowed the prospects for the educational activities and made teachers - who teach the discipline - question the usefulness of their work.

Through this paper, we have chosen to show that the work done by our colleagues (who came to teach at some point the discipline in question) in shaping a response to the current requirements of students and society, was not in vain. Today, partly dictated by the pandemic, partly dictated by the rise of digitalization, computer-assisted training in all its forms is more than necessary. From distance lessons to assessments made exclusively through dedicated software, respectively from smart glasses tools that help solve problems through control and external consulting to applications in the range of artificial intelligence and home automation, you can see how the training assisted by computer regains its former role and importance. This paper is based on a series of analyzes and studies, as well as observations in the context of teaching the subject (computer-assisted instruction), made from the perspective of the teacher, including those who taught the subject (more than 320 individuals). Various working scenarios were used, both in the face-to-face (onsite) and in the distance version (online), the development of the educational act, as well as reception and analysis of feedback being from the relatively recent field - generations of students from the last 3-5 years.

Drawing somewhat between traditional and computer-assisted instruction, based on studies and pedagogical experiments conducted nationally and internationally, we concluded that combining classical and computer-assisted instruction is the most plausible option for the next period (10 -15 years).

3. RESULTS AND DISCUSSION

3.1 Traditional Training versus Computer-Aided Training

Naturally, the computer has expanded its usefulness, penetrating almost all areas of activity and becoming indispensable in education. The critics who were brought against him now oppose counter-arguments; thus, teacher-student or teacher-student communication, as well as social exchanges between pupils/students are not slowed down, but on the contrary, they can be developed through video chat and discussion forums. The Internet facilitates social exchange, and the creativity of the student, implicitly of the student, can be developed through homework and application exercises. The teacher is the one who aims (or not!) To develop the imagination, the capacity for analysis or synthesis, to determine the student to make value judgments. This aspect is identical in traditional learning - it all depends on how the teacher organizes learning and not on the advantages or limitations of a computer, which does not have "magical qualities" but is simply available to the teacher and the student. (pupil or student), with an immense capacity for exploitation.

At the international level, research in the field of e-learning leads to the conclusion that this type of education can be at least as effective as that conducted traditionally, provided that certain "recommendations" are taken into account: compliance with strict planning, the emergence in the computer-based lesson of intellectual challenges and obstacles that require effort in overcoming them, the establishment of study groups, and the provision of specialized assistance to students (where appropriate) in understanding and using technology. Of course, the effective results obtained must be related to the training activity of the teacher or instructor, respectively a series of well-defined instructive-educational objectives, a set of quality lessons, a careful dimensioning of the application exercises and homework, comprehensive information and requirements, providing additional timely explanations, and, last but not least, feedback on the subject.

When it comes to online (or distance) training, an attractive interface is especially important. The online activity must be pleasant and offer intellectual satisfaction, the student to feel the

pleasure of a job well done, but also the satisfaction of “meeting” and communicating with peers. It is also necessary for the information to be varied, the application exercises to prove the diversity, and the interaction with the teacher to tend towards an optimal one. E-learning systematically develops metacognitive skills, the student being focused on how to solve the task because he is aware that in the future he will face such difficulties and that it is possible that at the next obstacle he will not benefit from any kind of support. Thus, he gradually becomes aware of all the steps that lead him to an effective result.

On the other hand, teachers involved in e-learning are supposed to have a great deal of freedom in the design and organization of the lesson, becoming, in turn, and as appropriate, counselors, mentors, partners, and collaborators of pupils and/or students in discovering the scientific truth, but also in performance analyzers and evaluators of their students. All these changes contribute significantly to the social adaptation of contemporary education, modernizing the teaching-learning-assessment activity, and constantly making the information and training sessions more flexible.

Thus, by resorting to computer-assisted instruction, the lesson began to take on various forms. As the main way of interaction between teacher and students, respectively as a landmark of school life, it judiciously stated its goals, offered the opportunity for “masterful performances” when trying to cover certain limits, but also discovered multiple opportunities and developmental valences of the individual's personality. From a monologue form, sometimes linearly monotonous, with small steps, it has acquired numerous interactive valences, reaching today to the form of teaching new contents through the computer.

On the other hand, in the "classic lessons", the teacher presents a large volume of information, structured, systematized, leaving the student the role of a passive receiver, which takes over the knowledge and the model of argumentative support of a scientific theory. The disadvantages are obvious - the student does not think about the information, but takes it uncritically (without going through his filter of values), thus developing only his memory, not his thinking; the relations between teachers and students are only of autocratic type, the teacher transmitting knowledge, without aiming at the possible misunderstandings of the other partners of the educational activity; passive reception imposes monotony and boredom (in the vast majority of cases), these aspects having practically nothing in common with intellectual activity.

To remove these shortcomings, at the moment an increasing involvement of the student in the teaching-learning-assessment activity is being tried, through a different conception and organization of the content to be taught-assimilated-evaluated, by promoting interactive methods and modern instructional design. With the advent of ICT, education has been revolutionized, with permanent interaction between learners, between learners and the teacher, but also between learners and content leading to quality computer-assisted learning, often much more effective than traditional education. Also, a new reality has emerged, where the user (teacher and students) together with the environment (educational context) and the computer form a mixed reality (conventional, perceptible, and virtual at the same time), as shown in Fig. 3.

Thus, in addition to the advantages already mentioned (individualization of learning, development of metacognitive skills, training of the ability to operate on the text, development of knowledge processes, information provided to the student, change of classical teacher roles, etc.), a computer-assisted lesson offers great freedom to the teacher, in the sense that he has great flexibility in choosing the strategies used, having the possibility to propose such a strategy or to choose it from those presented/made available to him through the Internet or programs dedicated.

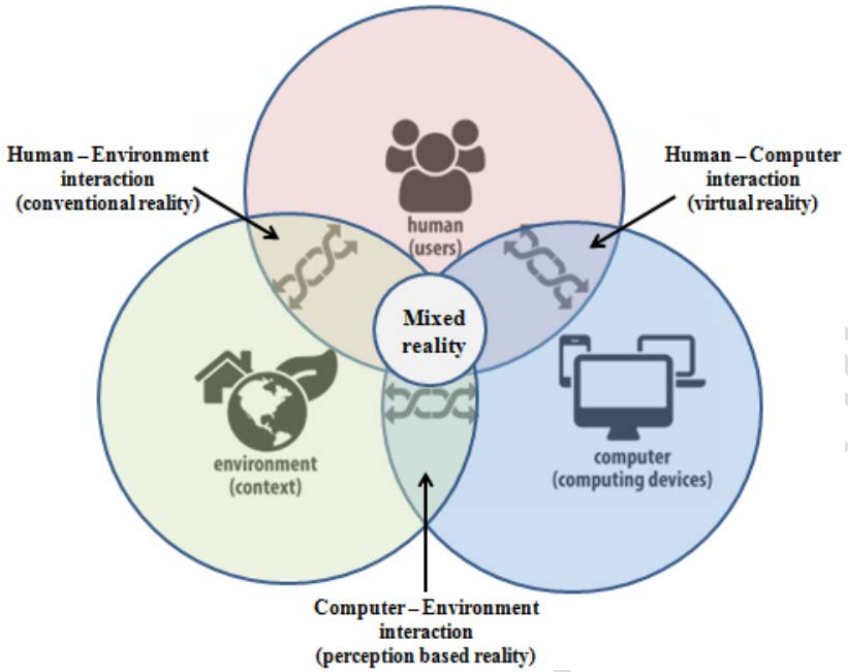

Fig. 3. The new reality associated with the user-computer-environment relationship [6]

In this way, the teacher has the opportunity to organize the work of students to help/assist them in identifying and solving problems related to the study, to identify their development possibilities, and to understand their cognitive individuality, aspect is much more difficult to achieve in the traditional lesson. However, both in the design stage and in the organization and implementation of a lesson conducted with the help of a computer, many questions arise (as if out of nowhere) than in the design and organization of a traditional lesson. The common questions that the initiator of a computer-based lesson should ask are most often and indefinitely related to:

- Who will create and improve the electronic material used?
- What technical or specialized skills do students need to be able to access this material?
- Who will give the students feedback or how much time will be allocated for feedback?
- How comprehensive should the material offer be and what is the optimal degree of difficulty of the tasks? (It is known that a material considered/perceived too easily does not arouse interest and generates boredom, while a material that is too difficult can lead to disorganization of the entire activity and giving up)
- How easily do students reach the formation of attitudes, skills, and abilities, and the achievement of learning performance?
- What is the way of evaluating students?
- How pleasant is it for a student to work online?

These are just some of the things that a computer designer should keep in mind. However, many difficulties or even shortcomings can arise during its development. Two important obstacles may arise in the development of computer-assisted instruction, namely the technological problem (some of the students do not have sufficient technical knowledge or lack the respective technologies and the managerial and communication practices of the teacher with the learners); possible ambiguity of the requirements, insufficiency of

explanations, etc.). If regarding the technological problem this is related to the endowments of the educational institutions, the managerial and communication practices are strictly related to the size of the configuration, design, and organization of the online lesson, but also a quality instructional design.

3.2 The impact of the teacher in training and his electronic portfolio

Beyond the traditional/classical teaching methods, a way to highlight the didactic competence of a teacher refers to the use of the electronic portfolio. Originally conceived as a way to evaluate the work of students, the portfolio has gradually expanded its area, gaining a multitude of purposes, including that of a tool used in teaching. Unlike the classic portfolio, the electronic one substantially increases the accessibility and availability of the contents presented (as shown in Fig. 4, by the variety of their organization and transmission: graphic, text, audio, video), being in at the same time, much more attractive and easier to handle.

Therefore, the electronic teaching portfolio represents a collection of data that highlights the work of the teacher, the teaching progress registered by him, as well as his professional development. These data include, most often and not limited to, lesson plans, examples of assessment activities (formative, summative, formal, informal), maps (including conceptual), tables, graphs, photographs, stories related to teaching and assessment, certificates of participation in various professional development activities, reflections on teaching, etc. Besides, in the case of the physical education teacher ("forced" by circumstances to limit his activity in the gym or outdoors), for example, we can discuss the addition of multimedia elements to the conduct of physical education classes or training.

Fig. 4. Various forms of materials that make up the electronic portfolio [7]

In addition to the fact that the electronic portfolio officially certifies the professional training of the teacher, it can also include objects, tools, and implicitly a series of activities that facilitate teaching. Thus, the contents to be taught and which are found in the portfolio, are presented in various forms that attract the attention of the audience through their originality, thus facilitating the retention of information and ensuring the durability of its preservation.

The applied and reflective exercises are used to increase the revelation of new meanings, the accessibility of information, thus leading to the formation of critical and creative thinking. Besides, the assessment made may be somewhat closer to objectivity. Such an electronic portfolio ensures total transparency of the teaching and evaluation process, encourages critical reflection on one's activity, which will inevitably lead to the improvement of teaching performance; it can be used successfully both in the traditional lesson (conducted onsite, in a dedicated space) and in the lesson conducted exclusively online.

For a digital portfolio to be efficient, it is necessary to go through several stages in its realization. Synthesizing several models that describe the process of developing a portfolio, many authors highlight the following steps:

- creating objects and collecting documents and working files that can be used in building objects;
- selecting lesson plans, photos and objects, respectively giving up those that are redundant or not representative;
- designing goals that focus on development, reflection on the teaching-learning process, and optimizing objects under the proposed standards.

A slightly simpler, but no less efficient model, suggests going through no less than four steps, as follows:

- the decision (determining the purpose, needs, and potential of the audience, the availability of essential resources, one's knowledge, as well as the skills intimately related to technology);
- the design (selection of the most suitable software, including the storage place and the means of presentation, as well as the creation of the system that brings the objects and the other elements that the portfolio requires to the standards imposed by the teaching);
- development (incorporating all objects, reflections, and graphics in a creative portfolio, which is intended to be unique to its creator);
- evaluation (appreciation of the entire content of the portfolio, the design, and the multimedia format in which it is presented).

As it is easy to notice, an electronic portfolio differs from the traditional one, both in terms of form and content, as well as in terms of the production process and the benefits for the author and audience. Given the fact that the technology is in a rapid and progressive development, which leads to a decrease in its costs, education can benefit from the widespread use of the electronic portfolio, which will be reflected in increasing the quality of teaching. The electronic portfolio offers more dynamics, diversity, and development, as well as more reflection and a holistic view of the teacher's work. Using the countless resources provided by technology, teachers explore multiple facets of teaching, presenting reality diversely and engagingly, not being confined to an often arid and dull text. By using the electronic portfolio in the training process, the quality of learning increases, as well as the quality of the teacher's work, the positive results being registered by both actors involved in the educational process.

3.3 Computer-Aided Training from current working hypotheses and scenarios to expectations and perspectives

Appearing as a solution to the problems of traditional education, computer-assisted instruction (today an independent discipline) has offered over time multiple possibilities and the most diverse learning. The wide development of new technologies and their penetration in various fields has made possible their implementation in the educational system, changing

the traditional roles of the teacher with new ones, and trying to optimize the classic relationship between teachers and students. The advantages, as well as the disadvantages, are multiple and sometimes intertwine. Thus, the autonomy offered to the learner is a "double-edged sword", because if a student is not sufficiently motivated and does not have an adequate will for the discipline in question, he can easily abandon this training method. The paradox, in the case of computer-mediated learning, is that, although communication is facilitated by technique, learning in front of the computer predisposes students to isolation. The student can most often opt for non-interaction with the teacher or other colleagues for various reasons (so as not to bother, because it is unpleasant to ask questions from the part of the content that he did not understand because he is already tired than when he starts studying, etc.).

Another paradox is highlighted by the fact that, although computer-assisted instruction is presented as a transition from a content-focused pedagogy to a pedagogy focused on the needs and interests of students, the emphasis is mainly on information and the formation of intellectual skills and abilities. , omitting the formation of purely practical skills, we can not perform, in the case of online education complex laboratory experiments or various other operations, but we can only model and/or simulate them virtually, thus the actual practice being replaced by "simulator learning"). Thus, not every discipline is suitable for computer-based education. On the other hand, computer-assisted training develops skills and abilities that, in traditional education, are minimized: the ability to self-train (self-learning + self-assessment), emphasizes the development of the ability to apply, analyze and synthesize being applicative or reflexive, no longer being, in the case of tests, reproductive subjects); the student's responsibility also develops.

The introduction of ICT in traditional education implies a change of didactic mentality, an overcoming of the common places, and a permissiveness to the new, which is not within everyone's reach. So, we can avoid "traditional mentalities", "barriers of convenience", which can or may not be overcome. Let's not forget that involvement in computer-assisted instruction involves additional efforts on the part of the teacher, we are practically talking about adapting the traditional design lesson and elaborated to the electronic form (or the total design of a module of computer lessons), the time given to students. correcting homework, for feedback, for additional explanations and instructions in solving tasks), identifying ways to motivate and support their learning appropriately. The benefits of students involved in a sequence of computer lessons are multiple: better motivation for the activity, more effective learning and a better understanding of the content, a higher quality of education and greater access to communication with the teacher, more communication between colleagues and unlimited access to self-assessment, respectively consistent and immediate feedback. On the other hand, the reality also reveals certain "problems" (or simply disadvantages) that occur in students involved in computer-assisted training - sometimes there is a certain level of frustration and dissatisfaction, or technical and logistical problems, or even possible confusion over requirements, but also low interest or even "displeasure" to ask questions.

Some of these disadvantages can be removed by better organizing the lesson and identifying optimal ways to increase students' interest and develop motivation. As ICTs have penetrated rapidly in all areas of activity, it is not possible to minimize their role in the educational process. The involvement of computer-assisted training in individual learning has made important contributions to the development of education. Thus, it is necessary to give this form of education the importance it deserves, constantly trying to improve its weaknesses and to eliminate, as much as possible and where possible, its shortcomings.

A series of comparative studies conducted for various educational variables revealed a series of regularities that can be retained as effects of computer use in education, of which we focus only on the following:

- age - most experiments show that computer-assisted training gives better results to students younger than older;
- level of education - students with modest school results progress better compared to those with meritorious results;
- economic (social) status - economically disadvantaged students outperformed those considered privileged, given that the former ensured familiarity with current computer-mediated study techniques;
- the intellect and development of the individual - students with various mental or physical disabilities have demonstrated increased learning abilities compared to the traditional learning situation; some studies even support a better overall evolution in the strict sense of the progress curve towards non-disabled learners;
- gender - a series of researches have concluded that differences in learning performance between girls and boys cannot be statistically significant, given that the most appropriate curricular areas of impact of computer-assisted training are languages, mathematics, and literature.

Pentru a înţelege mai bine relaţia cursant-computer, cercetătorii preocupaţi îndeaproape de atitudinile, emoţionalitatea şi feedback-ul acestora au inventariat şi alte beneficii ale utilizării computerului în procesul educațional: atenţie sporită, rezistenţă bună la oboseală, învăţare independentă, dezvoltarea capacităţii de autocorectare, divertisment şi joc asociat învăţării, individualizarea învăţării, ritm diferenţiat de lucru, recunoaşterea greşelii, obţinerea de feedback imediat, control asupra propriei învăţări, motivaţie superioară, evitarea completă a imparţialităţii datorate aspectelor privind rasa ori etnia, toleranţă crescută la frustrare şi implicit la teamă. Toate acestea ne permit să evidenţiem câteva consecinţe pedagogice ale utilizării calculatorului în educaţie, și practic să ne fundamentăm propunerea de a alterna ibstruirea tradițională cu cea asistată de calculator sau alte dispozitive:

- *stimularea interesului faţă de nou* - legea de bază ce guvernează educaţia asistată de calculator o reprezintă implicarea interactivă a cursantului în acţiunea de prezentare şi transmitere de cunoştinţe, captându-i atenţia subiectului și eliminând riscul plictiselii sau rutinei;
- *stimularea imaginaţiei* - de la jocurile pe calculator care dezvoltă abilităţi de utilizare, imaginaţia și viteza de reacţie, la prezentări grafice atractive, cursantul poate ajunge să creeze propriile instrumente soft;
- *dezvoltarea unei gândiri logice* - descompunerea unei teme în etape de elaborare organizate secvenţial și organizarea logică a raţionamentului reprezintă demersuri cognitive ce aduc câştig în profunzimea si rapiditatea judecării unei probleme;
- *modelarea unor obiecte* și *simularea pe ecran a unor fenomene și procese* (unele extrem de costisitor de reprodus în laborator) ajută la o bună înţelegere a acestora;
- *optimizarea randamentului predării* prin exemplificări multiple, mai cu seamă atunci când cursantul este *invitat să participe la propria formare prin autoeducaţie;*
- cursantul (elev și/sau student) *învaţă în propriul ritm,* fără emoţii şi stress care să-i modifice comportamentul;
- a*precierea obiectivă* a rezultatelor și progreselor obţinute.

To better understand the student-computer relationship, researchers closely concerned with their attitudes, emotionality and feedback have inventoried other benefits of using the computer in the educational process: increased attention, good fatigue resistance, independent learning, self-correction, entertainment and learning associated with learning, individualization of learning, differentiated work rhythm, recognition of error, obtaining immediate feedback, control over one's learning, superior motivation, complete avoidance of

impartiality due to race or ethnicity, increased tolerance of frustration and implicit fear. All these allow us to highlight some pedagogical consequences of using the computer in education, and practically to substantiate our proposal to alternate the traditional construction with the one assisted by the computer or other devices:

- stimulating the interest in the new - the basic law governing computer-assisted education is the interactive involvement of the student in the presentation and transmission of knowledge, capturing the subject's attention and eliminating the risk of boredom or routine;
- stimulating the imagination - from computer games that develop skills of use, imagination, and speed of reaction, to attractive graphic presentations, the student can end up creating their soft tools;
- the development of logical thinking - the decomposition of a theme in stages of elaboration organized sequentially and the logical organization of the reasoning represents cognitive approaches that bring gain in the depth and rapidity of judging a problem;
- modeling some objects and simulating on-screen some phenomena and processes (some extremely expensive to reproduce in the laboratory) helps to have a good understanding of them;
- optimizing the teaching efficiency through multiple examples, especially when the student is invited to participate in their training through self-education;
- the student (pupil and/or student) learns at his own pace, without emotions and stress to change his behavior;
- objective assessment of the results and progress obtained.

4. CONCLUSION

Against the background of the enthusiasm due to the appreciations of the information technology used in education, prudent attitudes were also outlined in the community of specialists, for example, the questions regarding the role of multimedia in training: Can multimedia replace the teacher? Can multimedia represent the perfect teacher, provide a perfect instructional strategy? Beyond all this, it can be said that good teachers are now better than machines in terms of decision-making and training design and that education must be done sequentially, alternating between classical/traditional (good and bad) training and computer-assisted (also with its advantages and disadvantages).

REFERENCES

[1] Anonymous. *Computer Aided Training (general course),* Faculty of Psychology and Educational Sciences, "Alexandru Ioan Cuza" University of Iasi, 2010; Accessed on 10.09.2020. Available: www.psih.uaic.ro/.../postuniv/12-13/IAC_curs_General.pdf

[2] Lesenciuc A., C*ommunication theories*, "Henri Coandă" Air Force Academy Publishing House, ed. a II-a, Brașov, 2017

[3] Cioruța B., Coman M., *A forey in modern scientific research of the environment. From EISs to Environmental Informatics*, Journal of Environmental Research and Protection (ECOTERRA®), Babeș-Bolya University from Cluj-Napoca, 2011; 8(29): 17-20 www.ecoterra-online.ro/files/1330955124.pdf. Romanian.

[4] Cioruța B., Cioruța A., Coman M., *Pleading for an environmental informatic culture forming need*, Journal of Environmental Research and Protection (ECOTERRA®), Babeș-Bolyai University from Cluj-Napoca, 2012; 9(30): 31-39 www.ecoterra-online.ro/files/1339069625.pdf. Romanian.

[5] Anonymous. *Issues of the institutional system and the educational process*, Department for teacher training, University of Medicine and Pharmacy of Craiova,

2009; Accessed on 10.09.2020. Available: www.umfcv.ro/files/p/e/Pedagogie_2.pdf. Romanian.

[6] Cioruța B., Coman M., Cioruța A.A., Lauran A., (2018) *From Human-Environment Interaction to Environmental Informatics (I): Theoretical and Practical Implications of Knowledge-based Computing,* Magazine of Hydraulics, Pneumatics, Tribology, Ecology, Sensorics, Mechatronics (Hidraulica®), nr. 1/2018, pg. 71-82 https://hidraulica.fluidas.ro/2018/nr1/71-82.pdf

[7] Coman M., Cioruța B., (2019) *From Human-Environment Interaction to Environmental Informatics (IV): filling the Environmental Science gaps with Big Open-Access Data*, Magazine of Hydraulics, Pneumatics, Tribology, Ecology, Sensorics, Mechatronics (Hidraulica®), nr. 2, pg. 52-61 https://hidraulica.fluidas.ro/2019/nr2/52-61.pdf