THE DEVELOPMENT OF METACOGNITIVE SKILLS AT STUDENTS

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ABSTRACT: In this study we present some results obtained after a training program that was basically instrumental enrichment program developed by Reuven Feuerstein. This program requires a methodology for targeted intervention in particular to improve cognitive abilities: memory, reasoning, attention, etc.. And especially to develop the capacity to coordinate these mental functions autonomously and actively. R. Feuerstein’s theory falls between metacognitive research aimed to achieve the level of individual awareness and monitoring skills and cognitive behavioral own, improving cognitive functions that allow to define more clearly the problems, establish connections, observing the relationship, optimization for motivation learning.

1. INTRODUCTION

Metacognition development is an important formative intellectual object in education of the students, as reaching this level involves a route through effective education, appropriate to each one in particular. Metacognitive processes by concerns that students are aware of their own cognitive activity, meaning learning activity, and self-adjustment mechanisms consisting in cognitive controls (rules, procedures, strategies).

Metacognitive goes in the same direction with the strategies used in developing cognition as well as their use in knowledge, learning and representation is formed, the image on the abilities, skills, and individual capabilities. Metacognitive represents self –adjustment about the possible level of knowledge and cognitive processes in general.

The main steps in the formation, affirmation of conscience gripping metacognition are (AH Schoenfeld's model):

- Affirmation of trust and intuition in solving the problems, tasks, based on knowledge, previous experiences, a sense of referral tasks, intuition a way of understanding and solving in an orientation relative to the possibilities;
- Personal reflection on the knowledge involved, the solutions found to resolve, instruments used, analysis and comparison, analysis on the difficulties of other methods previously used;
- Self-awareness or awareness of effective solutions addressed solving style, based on self-observed, analysis results and how to solve, progress and cognitive act. Stages show that metacognitive is associated with knowledge from management, and construction and it is the condition in which the knowledge appear.

Cognition managerial approach reveals the fact that metacognitive includes: awareness of how to understand the problem and how to resolve it, planning processes and pathways necessary monitoring application solutions, resource used, conditions, necessary instruments, decisions and analysis of results [3].

Outlet of conscience, as an element of cognitive education, as an expression of metacognition, according to the model proposed by FP Büchel, is formed in four stages:

- gripping shaping the conscience of their own learning style by automatism old scheme, reporting how their own understanding. It is a reflection on their own possibilities (process capability) due updating their working memory when the student is in a given situation to solve a problem.
- in the next stage is reached in a learning strategies to knowledge in the form of discussion group, to broaden the field of comparison and to improve objectivity self-reflected. Now is the confirmation of effective strategies already purchased and correction, rule out strategies partially effective or ineffective.
- the optimization processes are disrupted or not completed.
- finally, is the automation of new schemes, strategies appropriate style.

F.P. Büchel considers that training of metacognition is more favorable to work in groups, in a climate of cooperation, confrontation because there is a possibility, a comparison of mutual evaluation. In self-employment, individual student is concerned about more than solving the problem itself, the acquisition of knowledge and less understanding of how, knowledge, resolution, decision. They may occur at the end of the student and his question generalize experiences gained when a conflict cognitive and socio-cognitive (group).

After triggering cognitive conflict and socio-cognitive (group), through personal reflection and cooperation, a des-automation cognitive previous schemes inefficient and re-automation systems that ensure success in cognition, in solving the task. Metacognitive, as is done, help to turn the feedback on training students for knowledge. Thus, route-metacognitive cognition can be viewed and vice versa metacognitive-cognition and can speak not only a feature of metacognition but a facilitating metacognitive knowledge, learning.

Joita E. (2002) presents the results of research conducted by White and J.R. FREDERIKSEN, which shows that by facilitating metacognitive formulation of questions is a solution for the development of scientific thinking for knowledge through research.

The main arguments are:

A) Research in cognitive psychology from the last time, out highlighting the central role of metacognition in achieving effective knowledge and learning and training in research skills and cognitive abilities of expertise.

According to the constructivist model, learning through metacognition involves three basic questions that students use them in the analysis as tools:
questions concerning the construction, design of cognitive activity as reflecting a desire to learn the scientific knowledge, awareness and analysis of these steps are facilitated metacognitive;
  - questions on control, to conduct an evaluation criterion based on reflection on their own learning through research, quality made in construction, the steps taken, organizational activity, the methods of learning, students get to understand the nature of research and the conditions under which it is carried out effectively;
  - questions on general knowledge and reflection on it, especially in situations of repeated activities of the same gender, the occurrence of new research questions, students can formulate their own questions to further research, because the effect on training metacognition learning style by asking the questions.

In this way the categories of questions correlate with the stages of learning through research, it enhances metacognitive, the assessment criteria of knowledge and learning. This model indicates the criteria used by students in the evaluation process through reflection on knowledge, learning, in terms of metacognitive: delineation of the ideas, process understanding, the degree of inventiveness and systematic, the correlation between questions, the group forms and communication, etc.

B) Facilitating reflection through qualitative assessment, the interpretation criteria is supported by applying the criteria used by students in the evaluation process through reflection on knowledge and learning, and inserting them into a guide to use the end unit of learning, a way on a scale of assessment that give values for each criterion. Evaluation sheet completed by students as a way of self-knowledge at the group and then with the teacher. Scale indicates the full affirmation of the real development metacognition every student, and its influence on the knowledge, learning, and research ability, advanced. Such evaluation through reflection may be a separate module, curricular skills training, skills assessment, and reinforcement metacognition.

C) Regarding the facility metacognitive by formulating questions on the survey design and implementation of knowledge and learning in individual and group, experimental research led to the idea of intervention on the need essential components of the educational process, adapting to existing conditions: curriculum, methodology, organization, planning and evaluation.

D) Facilitating metacognitive is important also for teachers. And they should reflect on how they have designed the work, as they have done it, as they guided students, how they completed the evaluation. Sheet analysis built on the categories of questions after the business affairs should be the criteria to record reflections on the preparation and the final evaluation. Metacognitive supports management made such a successful class, improving the climate of making more active the communication.

Researchers built a model of hierarchical representation of the criteria-assessment questions in the classroom climate by events that occur: diversity awareness, respect for the style of others, commitment, encouragement, student-teacher relationships, student-group-class, learning with pleasure, use humor, participation comfortable and free expression of students.

2. THE INSTRUMENTAL ENRICHMENT PROGRAM

Instrumental Enrichment program is composed of a set of exercises divided into 14 tools that are used as means for developing mental capacities. The disciplinary content not because they do not concern the acquisition of specific knowledge, but the acquisition of mental skills, concepts used in different situations. Each instrument is focused on specific cognitive functions and provides purchases for developing cognitive capacities necessary for solving task that requires a high level of abstraction. The Instrumental Enrichment Program are: Organization Points; Spatial Orientation I. Comparisons; Analytical Perception; Pictures; Spatial Orientation II, Classification, Temporal Relations, Instructions, Family Relations, Numerical Progression; Syllogism; Relations Transferable; Sagome [6].

Exercises instruments in addition to images and temporal relations, which are organized differently and provide a gradual increase in difficulties so as to encourage the progressive acquisition of purchases necessary to solve successive years, thus strengthening the feeling of competence, autonomy in organizing intrinsic work and motivation. Recommended the granting of a wider reflection on the mechanisms that led to solving the tasks, so that subjects become aware of the importance and need for discussion about the work done and to make transfers on the basis of principles formulated during activity. Develop principles and implementation of transfers are very important elements. Finding a synthesizing principle is valid in a concise sentence and all the details of the page caught analyzed. Principle can highlight a problem that has been exceeded, a newly learned information, a particular reflection exercises that generated it, or a necessary element to resolve the page. The transfer is create a link between the principle result of reflection necessary for understanding and addressing pregnancy and everyday life. During the activity, will use two or more instruments to avoid monotony that may occur after using for a long period of the same type of exercises, or the feeling of failure resulted from difficulties in solving an exercise instrument . Also, instruments are studied so that purchases made by an instrument to strengthen up the use of other instruments. A particular route is the way the images, which is composed of humorous stories independent from each other. Each page contains a story that can be chosen depending on the requirements of the group that works brought at any time of the work after being gone the Organization Points.

Each instrument begins with a picture page (cover or homepage), which is used for placing the instrument, creating a horizon of waiting for motivation and development through the page.

Cover pages have certain features that remain unchanged from instrument to instrument to highlight the continuity of work, but each instrument is distinguished from others. Ombudsman oriented subjects to consider the symbol on the cover to deduce the exercises that will resolve the issues and that they will discuss.

3. ORGANIZE AN ACTIVITY OF THE INSTRUMENTAL ENRICHMENT PROGRAM

Organize an activity of the Instrumental Enrichment Program provides respecting some rules and some key moments: the introduction, individual work, discussion and conclusions [4]:
a) Introduction

By going through this phase mediator seeks awakening interest in the group over the work which will develop and define their problems they will solve. Revision begins with data from previous lesson. The mediator shall ensure that they were well understood concepts, requirements and assimilate the vocabulary necessary to solve the task. Students will learn to analyze the page autonomously. Earlier work trainer guides students in oral observation and development objectives.

b) Individual Work

After a brief introduction to the work to be done, students will be asked to solve an individual task, after which they are involved in a discussion aimed at highlighting possible strategies for solving page. It starts with solving the task on an individual, autonomous. While students work individually monitoring is required for their help and encourages those who have difficulties. It is recommended to avoid frustrating situations and competition. Students must understand that it’s important not to finish quickly the page. Is important to understand how to resolve a task and how they form and develop their implementation of certain powers them. Activity based on reflection, even if not fully effective, may be more useful than the one made in haste, because it allows analyzing the processes that formed it.

c) Discussion

When most students have completed the task individually start discussion. Being particularly interested in mental processes that led to finding the solution, it is appropriate to insist on correct answers and the wrong, to understand the mental processes through which solutions were found.

Choose an element of the since-along activities to formulate a general principle, then the transfer will be achieved. Through the insight to get to generalization. This discussion allows comparing the strategies and cognitive functions involved in solving the problems and errors, to find examples of everyday life, the subjects and extracurricular activities. At first it is recommended that the mediator to identify the link between work and other applied situations, then students will gradually create these connections between the instruments and the surrounding reality. Each transfer is built on a solid and appropriate explanation of the type of connection between the examples and the proposed developed.

d) Conclusion

At the end of each lesson there should be a revise of the whole activity. Even if it is short it should highlight the steps taken to achieve this objective, the new words acquired, targets and strategies set out above for the purchase. It is possible to encourage valorisation activities to determine individually or in small groups the utility obtained by applying the tools.

Development activities of the metacognitive skills students were conducted by applying the tools instrumental enrichment program developed by Reuven Feuerstein a group of 50 students from the Faculty of Engineering “Hermann Oberth” of the University “Lucian Blaga”.

4. APPLICATION OF INSTRUMENTAL ENRICHMENT PROGRAM

4.1. Organization Points

4.1.1. Project Activity – Cover

a) Objectives:

- To create a standby horizon;
- To explain the “thinking”;
- Identify the role of thought in human activity.

b) Mediation criteria applied in the work are:

- Intent and reciprocity;
- Transcendent;
- Meaning.

c) Strategies Work:

- The cover shows students, are asked to observe carefully, then try to find all important information. It aims to identify the images.
- It states that the phrase, “One moment”, meaning a vague and inaccurate, “a moment” indicates something undefined, is different from “one minutes”, which is a measurable time. Implementation activities may require a period of time different people at different times and in different contexts.

- Principles:
  - Browsing time involves aspects of subjective value.
  - Conduct an organization and requires a systematic control of all phases of work.
  - No human ability to order and organize reality, the universe could be considered an incoherent agglomeration of objects and events.

4.2. Organization Points

4.2.1. Project Activity - Page 1

a) Objectives:

- Create a virtual relationship through reproduction figure model;
- To develop strategies to solve;
- Organize a desktop;
- Identify the advantages and limits of a recovery model.

b) Mediation:

- Slow impulsivity;
- Removal performances of the type-test error;
- It fosters a feeling of confidence in the other;
- Stimulating subject in careful observation of the page;
- Recommendation to use the time to understand what to do.

c) Strategies Work:

- It shows page 1 students, are asked to observe carefully, then try to find all important information.
- It focused attention on the important data (the square and triangle);
• It stresses the need for precision and accuracy in the reproduction of figures.

Principles:
• Given a model that helps us in solving a task, therefore helps us to learn.
• Given a model that helps us in solving a task and therefore should value it.

5. CONCLUSIONS
• The result of research carried out leads to evidence of at least three essential aspects in the development metacognition on students:
  • Students balance their attention in preparation, implementation and evaluation of the educational and training process itself, but also their qualitative analysis. Metacognitive training becomes as important and basic tool in business efficiency, skill and competence affirmation management education;
  • In educational practice metacognition principles can be developed and applied efficient by students following a training program that included theoretical aspects and practical-application;
  • Metacognition components are usually observed only in the final stage of evaluation.

6. REFERENCES
ABSTRACT: Using the most effective methods in adult education depends largely on knowledge and mastery of the curriculum by the trainer. Effectiveness of the method depends on the adequacy of the objectives, content of activities, the capabilities of the group working on the modalities for evaluation of participants. For adult education the most appropriate methods shall be considered as experimental methods, methods involving a very activism of those who learned. Some specialists speak about pedagogy of learning, characterized by a behavior modification with a gradual adjustment of activities during repeated similar conditions. An important aspect in the activities with adult concerns motivating the creation.

1. METHODOLOGY’S ROLE IN ADULT EDUCATION

Using the most effective methods in adult education depends largely on knowledge and mastery of the curriculum by the trainer. Effectiveness of the method depends on the adequacy of the objectives, content business, the capabilities of the group working on the modalities for evaluation of participants. For adult education the most appropriate methods shall be considered as experimental methods, methods involving a very activism of those who teach. Some speak of a pedagogy of learning through training, characterized by behavior modification with a gradual adjustment of activities during repeated similar conditions.

An important aspect in the activities with adult concerns motivating the creation. Such a situation involves putting in an emotional tension, to whose achievement brings satisfaction, aspirations and development needs are likely to increase participation.

Following research undertaken were identified several conditions necessary for creating a motivating situation (Vințanu, 1998, p. 45): there is a positive interest for the work; presence of a continuous emphasis on work; resistance to fatigue and the critical moments; for the performance or progress made; rapidly conduct of activities.

Method of learning is the way of action, with which participants, under the guidance of trainer or in an independent manner, their own knowledge, their skills and forming habits, skills, attitudes.

Methods fulfilled certain specific functions:

• cognitive function (the method is a way to access knowledge and truths of action for appropriation of science and technology, culture and human behavior);
• formative-educational function (methods contribute to the formation of new intellectual skills and cognitive structures, attitudes, feelings, abilities, behaviors);
• instrumental function (the method serving as the technical implementation, which mediate achieve goals);
• regulatory function (method shows how to proceed, how to teach and how to learn, so as to obtain the best results).

The sequence is a teaching method, an detail, a technique limited action, or a customization of the method. The method is a set of related processes, considered to be the most appropriate in a case of training. Value and effectiveness of methods are subject to the quality and adequacy of the component processes. The relationship between method and process is dynamic, so that at any given time, can become a process under another method, as a process can sometimes become a method according to the relationship with other processes [5].

2. ACTIVE-PARTICIPATORY METHODS

Active-participatory methods have lately developed through broad multiplicity of forms, and developing content. Using these methods, may create some difficulties. They are due to educators that they may perceive as a threat of loss of authority and the convenience will not waive the classical methods, which exempt the participation of creative effort. The main advantages of the active methods are:

• engaging individuals in learning, which has the effect of increasing the quality of learning;
• increase learning motivation, subjects were involved and interested not only in the intellectual;
• replacement of the classic ways of self participants / groups.

In these methods include several methods of critical thinking, which involve active participation and creative learners.

2.1. Method of learning in small groups (Student Team Achievement Divisions - STAD)

Method STAD assumed through three stages:

• the first stage is the presentation topic / problem;
• in a second stage takes place in a group activity. Participants are organized into heterogeneous groups of 3-4 members, discuss on the theme given to each other asking questions, compare and evaluate responses. The debate continues until all members are convinced that the master said;
• the third stage is evaluation. Educators ask participants to test the knowledge itself. Each group presents its own for assessing the achievements that can be compared to a better understanding.

2.2. Method Tour between teams (TGT-Teams Tour Games)

Method T.G.T. promote similar procedures with the Stade, with the difference that at the end of the cycle of learning takes
place in a tournament team, participants competing with their peers, having the same level of competence. So, working groups, which have the task of learning, are announced to enter into competition with each other on a given sequence and strategy group learning becomes competitive. For the purposes of the activity is recommended that certain conditions: each team has a first name, its members participate in a tournament and try to accumulate as many points, each group needs a set of questions and a summary score; in the group is achieved by distributing roles (one who asks, the answer, the recorded score).

2.3. Method mosaic (Jigsaw)
Mosaic method involves crossing following steps:

- formation of working groups baseline. Participants are divided into groups of 4-5 students, by counting from 1 to 4-5, so that each student has a number between 1 and 4-5;
- dividing the text to be studied in many parts many groups were formed initially;
- formation of groups of "experts" and resolution of pregnancy. Persons with the number 1 will form a group, the number 2 with the second group, etc. Each group of "experts" have the task of studying a particular part of the text, discuss the ideas of the text, to better understand how and then teach it to other colleagues;
- return the original participants in the groups and other teaching contents prepared colleagues.

This method, based on reciprocal teaching, promote effective learning of content information. At the end, each person must master the whole text and not just the learning that took part as "expert". During reciprocal teaching participants may require further clarification about the fragment respectively. Also, questions can be addressed and other "experts" in that group.

Educators monitor activity throughout the deployment, ensuring that information and knowledge is transmitted and assimilated properly. If students have difficulty, the teacher helps them to overcome the situation.

2.4. Method SINELG (Interactive Grading System for efficiency of reading and thinking)
The method aims to maintain the active involvement of participants thought reading a text, monitoring the level of understanding of content ideas, learning effective. Participants are invited to read carefully the text for analysis. During the lecture of one text, participants must be on some signs of having a specific meaning. Thus, students are asked the following:

a) put a tick (√) on the text where the ideas confirms what they already know or think they know;
b) put an addition (+) where information read is new to them;
c) put a minus ( - ) read where information contradicts or is different from what they knew or believed that I know;
d) put a question mark next (?) ideas they seem confused, unclear, or if they want to know more about a particular thing or issue.

As before reading the text on the side of these four were signs, depending on the degree of knowledge and understanding of them. These signs show a certain relationship to the reader with the text, with its ideas.

To monitor text ideas and the degree of understanding is a useful table with four columns corresponding to the four categories of signs used on the extracted text. SINELG is a useful method for achieving a sustainable and effective learning based on active cognitive involvement in reading a text on monitoring their understanding of the content of its ideas.

2.5. Cube method
Method cube can be used in stage conjuring and the reflection and allows addressing a topic or topics from various perspectives. Work can be done individually, in pairs or in groups.

Participants are asked to write on each side of a cube of paper or cardboard words or ideas, according to instructions.

- describe → How does he look like?
- compare → Who / what is like and who / what is different?
- associate → What makes you think?
- examines → What is, what is done?
- apply → How can it be used?
- argue for or against → Good or bad? Why?

Thought processes involved are similar to those present in B. Bloom's taxonomy. Through such activities are carried out involving students in understanding informational content.

It is desirable that the activities of participants to follow the order indicated above (in this connection the cube faces may be numbered), but is not necessarily required to do so. Can begin to solve the task on any given side of the cube. Is important to make students to understand the tasks and purposes for their learning.

To give an example it is better that the teacher to write him during this activity, demonstrating that the group is a member of the class understood as a community that learns.

3. EXPOSITORY METHODS
Methods expositive the ways oral presentation of topics logically organized and presented fluently. They are based on the communication process, i.e. the existence of a transmitter which has a vast amount of knowledge related to the theme and an audience interested in the content presented. There are various forms and ways of conducting expositive methods, but there is a common strategy for all forms. In the literature are formulated a series of rules relating to use methods expositive. They are:

- no idea should not be presented without being supported by facts or the facts without being accompanied by an idea;
- whatever the method of presentation, it must always include an introduction, content and conclusion;
- audience should know pretty quickly what will speak, for what purpose and what will happen discourse;
- whatever form is necessary to consider the interests of the auditor.

Exposure consists of a lecture by the teacher, orally, a large volume of knowledge, ideas, theories, concepts, through a concatenation of logical reasoning, by confrontation and argumentation as detailed by the systematic factual material around themes through various analysis, the survey complex links between facts and phenomena. This method requires a high level of understanding of participants’ maturity responsive. Lecture is used when the material to be taught is rich and new participants. Since the theme is developed through exposure to the teacher, it raises a number of matters relating to participants’ work, restricted to the mere reception
and a passive attitude, devoid of critical spirit. Excessive use of lecture lead to formalism and superficiality in the learning process, because communication between teacher and students is unidirectional, feed-back is very weak, and individualization of teaching and learning there. To prevent this, maintaining the use of a series of processes directed toward capturing the attention, interest and curiosity, to trigger a positive motivation by appeal to the questions, taking position on some problem sequences, etc. discrimination value. To have a logical and systematic lecture must be conducted on the basis of a previously established plan, which has an indicative value and are applied differently from one situation to another. Exposure may be on various topics, but it's necessary to respect the following rules:

- there is one central idea;
- shall be either inductive or deductive;
- subject defines the beginning;
- how the approach to be consistent with the level of understanding of the particulars.

Exposure contains demonstrations based on facts which interested audience. Duration is up to 40-45 minutes. Steps needed in preparing the exposure are:

- training ideas;
- training material (medium to support ideas);
- Psychological preparation of the exhibit that.

e) Conference popularization

Exposure different from content and level of knowledge relatively low audience. By popular conference aims to make known to all an idea or a new high content current. Duration is 40-45 minutes.

f) Course Judge

Draws broadly from the university and its purpose and understanding and establish upper links between knowledge set. Duration is approximately one hour.

4. INTERROGATORY METHODS

Approximately 60% of adults with activities taking the form of debate. Interrogatory methods efficiency depends on the observance of rules:

- clear determination of the objects observed;
- consistent definition of concepts, ideas, principles;
- how the approach to be consistent with the level of understanding of participants;
- to be able to predict participants’ attitude towards development.

Trainers must demonstrate willingness to listen to the participants, interventions driver debate is carried out in key moments and to incite discussion or intervene in times of impasse.

4.1. Brainstorming

Brainstorming (assault or ideas) is to develop within a group, the spontaneous and continuous flow of solutions, original ideas needed to solve problems. Brainstorming is a method of search and individual creations but also of confrontation, the choice of solutions developed in the group. Structure method comprises two distinct phases:

- Stage production of individual ideas (announcing the theme / problem to solve, the issue, preparing the participants to as many ideas and solutions for solving the problem);
- Final stage assessment ideas (concluding meeting assault of ideas, evaluate ideas and conclusions setting).

The rules to be followed in this method are:

- Stimulating the production of more ideas;
- Take ideas issue further, completing, improving them;
- Suspend intervention on critical ideas issued;
- The ranking value of ideas / solutions issued.

Themes that may be subjects of debate for this method:

- Find some ways to improve education in rural areas of our country.
- Identify some effective measures, that you take as a manager of an educational institution in the implementation of a desegregation project.
- What strategies for preventing and combating school absenteeism, to adopt as your teacher?

4.2. Symposium

Involves the presentation of short exposures (not more than five), which lasts between and 20 minutes.

Be determined in advance:

- the place where the symposium;
- problem with that start;
- who starts;
- what ideas should be emphasized and how long on average each intervention.

4.3. Colloquium

Involves a moderator and 5-6 specialists, 3-4 representatives of audience and audience. Moderator states order, facilitating interventions, the exchange of views of experts and audience intervention.

4.4. Consultation

May be issues in various areas, collective or individual. Implies the need to know more and after a demarcation problem it is performed in sequence on successive questions and answers.

4.5. Round Table

Used in the demonstrations and implies a scientific development with 3-5 participants, or a group of 15-20 people. Duration is 40-45 minutes.

- state who are participants who are needs for knowledge of them;
- defining the problem is the fragmented sequences, each sequence then it corresponds to an idea;
- state an idea which are announced by the facts and arguments supporting the idea or not. In the final conclusions and make assumptions for a new debate.

5. CONCLUSIONS

- Method of learning is the way of action, with which participants, under the guidance of trainer or in an independent manner, their own knowledge, their skills and forming habits, skills, attitudes. In these methods include several methods of critical thinking, which involve active participation and creative learners.
- Using these methods, may create some difficulties. They are due to educators that they may perceive as a threat of loss
of authority and the convenience will not waive the classical methods, which exempt the participation of creative effort.

6. REFERENCES

A NEW PSYCHOLOGICAL THEORY FOR AN ARTIFICIAL INTELLIGENCE ENGINE

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ABSTRACT: The paper sets to present the mathematical laws which govern the dynamics of psychological instances. These laws would be included in a soft component of an artificial intelligence engine. The mathematical approach led to the following conclusions: the dynamics of the psychological state is governed by a mathematical law represented through a second – order partial differential equation; at person’s level, the need for psychological stimulation is constant; the dynamics of the defence mechanisms is determined by an active component which has to satisfy adaptation to the inquirer environment and by an inert component, manifested through the constant need for psychological stimulation; the purpose of the inert component might be the stimulation or the inhibition of the inquirer environment; the deletion of the possibility of the specific expression of a person is determined by the alteration of the constant that is the need for psychological stimulation.

1. INTRODUCTION

The dynamics of the tensional states [8], [9] dictated by complex informational feedbacks, is a remarkable regulator for the outlets of personality manifested in the behavioral plan.

The activations of the lack of balance, at physiological level, as well as at superior levels, with direct connections to the register of human needs, constitute the informational inputs for the potentiality of tensional states.

The evolution mechanisms of the tensional states are responsible for the repartition of the excitation energy, a possible source for the appearance of psychological lack of balance. Their functioning is analogous to the functioning of selectors, influencing the quality of psychological statuses.

The preservation of un-altered psychological statuses involves the permanent activation of certain commands for the rehabilitation of the psychological system, materialized in the inhibition or the excitation of tensional dynamics [5], [6].

The regulation of tensional states in conditions of altered dynamics asks for the employment of certain “optimal control” type programs that should transform the system into a viable one, under conditions of utmost efficiency (time, resources, etc.).

Dealing with the dynamics of psychological statuses raises the problem of finding corresponding forms of the representation of tensional states.

The tensional state, modulated by the perception of the tension, is determined by the lack of balance materialized in needs (physiological or superior needs). The association between tensional states and needs offers flexibility in representation, using Maslow’s idea in a form generalized through the imaging of a construct with “c” levels.

The register of any tensional state has three phases: birth – evolution – gratification. If the phase of evolution obeys the laws of dynamics, the birth and the gratification phases are the effect of the strategies of the cognitive system to allow or repress the tensional state. Thus, the tensional state can be defined by a couple of measures (α, β), designating the activation level, respectively the gratification strategy adopted by the psychological system. At each level of activation “c” possible strategies of gratification are associated and a total of “c×c” gratification strategies are also associated to “c” activation levels.

The figure below represents, in a simplified classification based on three levels, the activation of a tensional state at the 1-st level – generated by a physiological need – that is to be gratified (extinguished) through a 1-st (I.1) level strategy. The exhaustion of the expected horizon of gratification leads to a tensional state of maximum amplitude that is to be gratified through a 2-nd (II.2) level strategy.

Figure 1. A possible representation of the gratification strategy of a tensional state

In this frame of representation the dynamic laws of the tensional states should be identified.

Amazingly, at the psychological level, things seem to be in contradiction with the reality of the physical world, where bodies of high density attract the flow of matter positioned in a certain area of proximity. But, at the psychological level, we deal with the flow of attention. The only way to solve the contradiction, at least at the conceptual level, is to accredit the idea of the existence of certain “germination processes of the tensional states”, an idea that we will be dealing with in the following paragraphs.

At the psychological level, the more a tensional state increases in amplitude, the more it tends to attract the flow of attention. The dynamics of the tensional states is limited by the capacity of administration of the cognitive system. The guarantee of the strategy given by the cognitive system to the gratification of the tensional state is doubled by the expected horizon of a gratification (in terms of psychological experience). The amplitude increases in the same time with the approach to the expected limit of tensional extinction and in the same time with the increase of the ratio between the current neuro-psychological activation and the minimal one needed for the activation of attention.
For the dynamics of the amplitude of the tensional state, we propose the following relation:

\[ b_n(t_i) = a^{-(n+1)} \frac{1 + \ln m(t_0)}{\ln m(t_i)} \frac{\ln m(t_i)}{1 + \ln m(t_i)} \]  

(1)

where:

\( i \) – the degree of the tensional state;

\( t_i \) – the psychological experience – the unit of measure is “second x piece of information” – which is associated with the tensional state \( i \);

\( t_0 \) – the resident psychological experience which is determined by personality;

\( n \) – the degree of the failed gratification;

\( a \) – the number of sources which generate the tensional states;

\( m(t_0) \) – the ratio between the current neuropsychological activation and the minimal one which is necessary for the activation of attention;

\( m(t_0) \neq [0,1] \).

When \( t_i = t_0 \) then \( b_n(t_0) = a^{-(n+1)} \). In the following paragraphs we will analyze the interesting case \( t_i \neq t_0 \).

What is the meaning of the number of gratifications and what is the connection with the consistency of the tensional state? The reach of the horizon of expectation for the gratification of a tensional state coincides with the exhaustion of the possibilities of administration of a superior dynamics. In the absence of tensional extinction, the cognitive system interferes through the identification of a “derived tensional state” connected to “the original tensional state” and through the evaluation of a new horizon of expectation. The derived tensional state increases the consistency of the original tensional state, tending to quantitatively orientate the flow of attention toward the last one. A new failed horizon of expectation will attract “the germination of another derived tensional state” from the tensional state previously derived, and so on. The hermetic quality of this point of view is checked through the fact that the germination of the tensional state supposes a tensional amplification, determined by the capacity of the cognitive system to identify the original causes. The passing from the original tensional state to the derived tensional state is followed by an amplyfing, at least at the perception level, of the psychological tension. This is an adapted form of Heisenberg’s uncertainty principle, which leads to behaviors of the “black hole” type.

In the psychological plan, a tensional state, disposing of a certain degree of “failed gratification”, becomes a sufficiently powerful attractor in order to make impossible a psychological de-tensioning. The same effect is produced by the inhibition of the original dynamics of the tensional state, associated with a correct dynamics of the derived tensional state(s). The register of the resetting of a psychological system on wrong formulae should be completed with the situation of a correct dynamics of the original tensional state associated with an incorrect dynamics of the derived tensional state. In this case the cognitive system interferes by correcting the altered dynamics.

Beyond these specific aspects of representation, very important by the perspectives they offer in the research of psychological pathology and, in the same time, in the research of the conditions for the resetting of the psychological system on correct formulae, we believe that interest should be focused on the research of the laws of the administration of tensional states, applied by the psychological system. The enunciation of these laws, provided they are correct, would describe the administration capacities of tensional states. They are important for the analysis of the process of tensional habituation in terms of the person’s specific fundamental formulae.

In the following chapter we present a mathematical model starting from the theoretical framework of the representation of tensional states described above and from a group of four differential equations, describing the behavior of certain essential psychological measures which are involved in the tensional dynamics.

2. THE MATHEMATICAL MODEL OF THE QUALITATIVE DYNAMICS OF TENSIONAL STATES

The approach starts from the following hypothesis:

The variation of the psychological experience \( (t_i) \) function in physical time \( (\tilde{t}) \) is given by the capacity of the stimulus to attract attention \( (\epsilon) \). Its turn, the capacity of the stimulus to attract attention is dependent on the capacity of the person to value the stimulus \( (v_i - \text{apperception}) \):

\[ \frac{dt}{d\tilde{t}} = \epsilon(v_i) \]  

(2)

The variation of the ratio between the current neuropsychological activation and the one necessary for the activation of the attention \( (m_0) \) function in physical time \( (\tilde{t}) \) is inversely proportional to this ratio \( (m_0) \):

\[ \frac{dm}{d\tilde{t}} = -\alpha m_i \]  

(3)

where \( \alpha \) is a positive constant.

The variation of apperception \( (v_i) \) function in physical time \( (\tilde{t}) \) is inversely proportional to apperception \( (v_i) \):

\[ \frac{dv}{d\tilde{t}} = -\beta v_i \]  

(4)

where \( \beta \) is a positive constant.

The variation of the amplitude of the tensional state \( b_n(t_i) \) function in physical time \( (\tilde{t}) \), is:

\[ \frac{db_n(t_i)}{d\tilde{t}} = -\frac{1 + \ln m(t_0)}{\ln m(t_i)} \frac{\alpha n^{-(n+1)}}{(1 + \ln m(t_i))} \]  

(5)

It is easy to see that this relation can be obtained by computing the temporary derivation of the relation (1).

Taking into account the fact that the measures \{ \( t, m, v, b \) \} are associated with the tensional state “\( i \)”, in the following paragraphs we will ignore this index. The measures which are associated with the index “0” are constant because they depend on personality and not on a tensional state.

Connected to these differential equations, the main problem is to see if they allow structures which admit of equivalences between two systems having the same properties or structures.
that do not allow equivalences. This subject presents a great interest in psychology, because it opens a direction of research into the tensional habituation process in terms of the person’s specific fundamental formulae. The main question which must be asked is to see if the habituation really exists or if it exists preserved in self-reproducible, inflexible formulae. Technically speaking, the problem consists in identifying the relative invariants and, if possible, in identifying the absolute ones for the system mentioned above. The invariants can be determined starting from the associated system of Pfaff forms. In this case, the system of Pfaff forms is:

\[ \begin{align*}
    ds_1 &= dt - c(v) d\bar{t} \\
    ds_2 &= dm + am d\bar{t} \\
    ds_3 &= dv + \beta d\bar{t} \\
    ds_4 &= db + \frac{1 + \ln m(t_0)}{\ln m(t_0)} \cdot \frac{a^{-(n+1)}}{(1 + \ln m(t))^2} d\bar{t} \\
    ds_5 &= dt
\end{align*} \]

The above system is determined, making exception of the following transformation:

\[ ds_1 = ad s_1, ds_2 = bds_2, ds_3 = cs d_3, ds_4 = ds_4, ds_5 = eds_5 \] (12)

where \( a, b, c, d, e \) are arbitrary functions.

We assume that \( ds_2 \) and \( ds_3 \) are not completely integrable, which imposes the following conditions:

\[ \begin{align*}
    -\frac{a^2 m}{\beta c v} &= 1 \\
    \frac{am}{c} \cdot \frac{\ln m(t_0)}{1 + \ln m(t_0)} \cdot \frac{(1 + \ln m(t))^2}{\alpha^{-(n+1)}} &= 1 \\
    \frac{a^2 m}{c^2} &= 1 \\
    -\frac{\beta v}{ac m} &= 1 \\
    -\frac{\beta v}{c} \cdot \frac{\ln m(t_0)}{1 + \ln m(t_0)} \cdot \frac{(1 + \ln m(t))^2}{\alpha^{-(n+1)}} &= 1 \\
    \frac{\beta v}{c^2} &= 1
\end{align*} \]

\( c \) independent from \( v \)

\[ \begin{align*}
    -\frac{1}{c} \frac{\partial a_2}{\partial m} &= 0 \\
    -\frac{1}{c} \frac{\partial a_3}{\partial v} &= 0 \\
    -\frac{1}{c} \frac{\partial a_4}{\partial t} &= 0
\end{align*} \]

This system is verified for:

\[ \begin{align*}
    \alpha &= 1 \\
    \beta &= 1 \\
    c &= -1 \\
    m &= 1 \\
    v &= 1
\end{align*} \] (23)

The solution of the system shows us that the tensional states do not have amplitude \( b_n(t) = 0 \). This result is valid only in the case of the blocking of defence mechanisms or in the case of their non-existence.

The relations in finite terms for the group (12):

\[ \begin{align*}
    ac - b &= 0 \\
    ad - b &= 0 \\
    ae - b &= 0 \\
    ce - b &= 0 \\
    de - b &= 0 \\
    ab - c &= 0 \\
    ad - c &= 0 \\
    ae - c &= 0 \\
    be - c &= 0 \\
    de - c &= 0
\end{align*} \] (24)

Complex calculations have led to the obtaining of absolute invariants equal to 1, absolute invariants equal to 0 and absolute invariants equal to -1.

Since the invariants are constant, it results that tensional habituation does not exist as a process! This process is preserved in self-reproducible formulae.

3. THE RATIO DEFENSE MECHANISM – TENSIONAL ADJUSTMENT

The defence mechanism theme has made a strong come back in topical preoccupations field, although it was excluded from academic speech for a number of years [3], [4]. Many cognitive psychologists assign a major role to defece mechanisms in the approach to the explanation of psychological functionality [1].

There are also preoccupations with the purpose of standardization of the defence mechanisms inventory [7], the identification of the deep structures of these mechanisms by discovering the specific motivational and cognitive determinants, quantification and testing. Beyond the theoretical approaches which have an important role in increasing the coherence of psychological theory, the applications of the defence mechanisms theory constitute a priority in the clinical domain.

It’s difficult to identify a coherent theory of the functionality of defence mechanisms because they cannot be seen. They constitute unobservable pieces of a puzzle which defines an observable structure – behaviour. We have the strong conviction that the reason of the credible existence of defence mechanisms submits to certain laws which define the fundamental formulae of the functionality of the psychological system, specific to the person. In this statement there is a
seeming inconsistence generated by the term „fundamental formulae”. The term must be understood as an essential structure which must be maintained by another structure or other structures which describe the particular. The essential visible structures in psychology present the characteristics of repeatability, measured by constants or recurrences. The essential structures are strong structures which are also maintained in the specific conditions of psychological lack of balance. It is interesting to treat the case in which the weak particular structures become strong structures in the sense mentioned above. We infer here the activation of certain severe mechanisms of overlapping between homeostasis and entropy with negative consequences in distinguishing between these two natures. The approaches which focus on the essence of defence mechanisms suffer of inconsistence, just by being inefficacious in identifying the essential.

The particularity of the action of defence mechanisms consists in the breaking of the equivalent evolution tendencies of the psychological measures (constants, linear, exponentials etc.) for the purpose of the preservation of unaltered psychological statuses. The defence mechanisms become active when the meters of the cognitive system detect values which are placed in the tolerance area of the psychological system integrity.

The couple “defence mechanism action – psychological measures, “those dynamics” is governed by invariance laws (laws of the type $M^o M_a \rightarrow \text{invariant} \}$ which assure the dynamics of the psychological system in its functional parameters. The invariance laws, at least in psychology, could be interpreted as dynamic equilibrium laws, which have the capacity of describing the whole functional register of the psychological system, from the right (re)structure formulae to the wrong resetting formulae.

The essence of the defence mechanisms functionality consists in the preservation of certain specific restoring formulae of the psychological system as an effect of annihilating entropic tendencies (internal or external).

The activation frequency of the sources generating tensional states is, to a large extent, determined by the specifics of tensional habitation which restricts the domain of activation of the tensional states selector to those options that are meant to avoid the unpleasant and to conserve the pleasure. Each of the two components – the unpleasant and the pleasurable – amplifies in its dynamics the potential of switching to the opposite state, so that the firming up of tensional habitation determines the parallel and permanent functioning of defence mechanisms meant to preserve the formulae specific to a person’s system.

There are serious reasons to advance the idea that the action of defence mechanisms can be described by using gradient type measures. These refer to the target of these actions, which consists in the counteracting of non-specific tendencies of dynamics of psychological measures. The effects of the action of the defence mechanisms appear – as purpose – in psychological experience. We could interpret the activation of these mechanisms by using a function of psychological experience that should, of course, be a gradient. However, this gradient influences simultaneously the dynamics of apperception, of neuropsychological activation and of the amplitude of tensional state, which makes it possible to identify it mathematically through a coefficient $(a_{ij})$ of the metric tensor $ds^2 = a_{ij} dx^i dx^j$. For reasons presented above $a_{ij}$ should not be a constant. The presence of constant coefficients designates a non specific situation, determined by the blocking or the lack of defence mechanisms [10].

Taking into account the aspects mentioned above, we present a mathematical procedure of the determination of the action of defence mechanism which is involved in the dynamics of neuropsychological activation, apperception and amplitude of the tensional state.

3.1. The mechanism of tensional adjustment in the metrics of the tensional state dynamics

The presence of the tensional adjustment mechanism should fit in the metrics formula in the form of a function of psychological experience that should modulate the dynamics of the ratio between the current neuropsychological activation and the minimal one needed for the activation of attention, of apperception and of the amplitude of tensional state. The complete metrics should have the form [11]:

$$ds^{(IV)} = (dx^1)^2 + h(x^1) [3(1)^2 + (dx^1)^2 + (dx^2)^2]$$

(26)

where: $t$ - physical time, $x^1$ - psychological experience, $x^2$ - the ratio between the current neuropsychological activation and the minimal one needed for the activation of attention, $x^3$ - apperception, $x^4$ - amplitude of the tensional state.

We will identify the tensional adjustment mechanism “$h(x^1)$”, using the three-dimensional metrics

$$ds^{(III)} = h(x^1) [3(dx^1)^2 + (dx^3)^2 + (dx^4)^2]$$

(27)

For this metrics, the Christoffel’s coefficients of the second degree are all zero with the exception of:

$$\begin{vmatrix} 2 & 3 & 4 \\ 1 & 3 & 14 \\ 1 & -2 & h \end{vmatrix}$$

(28)

Using the Riemann symbols of the second degree

$$R_{121}^3 = -R_{123}^1 = R_{131}^2 = -R_{131}^3 = R_{141}^2 = R_{141}^3 = 1 \left[ \frac{h'}{h} - \frac{1}{2h} \right]$$

(29)

and the supposition that the three-dimensional space $(x^2, x^3, x^4)$ is maximally homogeneous, the expression for the coefficient “$h(x^1)$” – which presents psychological significance – results:

$$h(x^1) = \frac{4}{(\alpha x^1 + p)^2}$$

(30)

where $\alpha$ and $p$ are constant, $\alpha x^1 + p < 0$.

Thus, the complete metrics for tensional state dynamics is written:

$$ds^{(IV)} = (dx^1)^2 + \frac{4}{(\alpha x^1 + p)^2} [3(dx^1)^2 + (dx^3)^2 + (dx^4)^2]$$

(29)

(31)

The partial differential equation associated to this metrics – if $x^1 = \chi^2 + x^1(0)$ where $\chi$ is the capacity of the stimulus to attract attention – is written:
\[
\frac{\partial^2 u}{\partial t^2} = \frac{(O_t + P)^2}{4} \left( \frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial x^2} \right)
\]

(32)

where \( O = \chi_0, \ P = ox^4(0) + p \) and \( \chi \) is a constant.

This equation is valid only in the situation in which the functionality of the psychological system is possible in the lack of the mechanism of the need for psychological stimulation.

4. PSYCHOLOGICAL SYSTEM – MATHEMATICAL LAWS?

The dynamics of human behaviour depends on a subtle energy which is governed by inflexible laws imposed by the functionality of the psychological system and by laws determined by the processing of stimuli.

The ratio between the homeostasis – represented by the actions of defence mechanisms – and the entropy of certain psychological measures modulates the tensional dynamics of the person. We advance the idea of the existence of a certain specific mechanism of this ratio which resets the human psychological system correctly.

Every person has certain specific instruments to solve any emotional situation. The attitude responses to psychological challenges require the selection of those behaviour strategies which minimize regret and amplify pleasure. The building of responses constitutes itself a process consisting in searching and testing of the behaviour recipes which satisfy the optimum criteria of the psychological dynamics having as purpose the avoidance of unpleasant states and the search for pleasurable states.

What is essential and what is variable in transactional “challenge-response”? The pointing out of the essential feature presupposes the acting of an equivalence class of a ratio in which the engaged resources oppose a certain destructive potential. Technically speaking, in this ratio a certain tolerance of the entropy of psychological measures and a certain capacity to adjust this entropy are involved. This means that different situations could be treated in an equivalent manner. This is a striking conclusion!

If our judgment is right, it means that the human psyche approaches problematic situations in a similar way. But this fact proves the myth of psychological invincibility.

At the conscious level, a new structure is needed, which has to bring out the problematic situations. This structure should have the behaviour of a special consciousness which has to distinguish between the potentials of using its products. The interpretive potential of the conscious instance is recorded by the tensional effort – a weak structure which preserves the equivalence class – mentioned above – specific to a person. The reason for preserving it is to assure the simultaneous functioning of strong and weak psychological structures and, of course, of psychological instances. At psychological level, the entropy and the adjustment of entropy are assembled in different structures. The structures must be compatible, meaning that these are acting on the basis of certain formulae which have to assure the accurate functioning of the psychological system. The variability of the psychological energy suggests for the unconscious instance equivalence class type structures, functioning on the basis of a constant ratio “anti-entropy/entropy” and for the conscious instance and its peripheral instance, the special type structures functioning on the basis of the formula “anti-entropy + entropy”. The functioning of the psychological system presupposes the existence of a certain control structure of the functioning of psychological instances along predefined formulae.

The psychological dysfunction appears as an effect of the vulnerability of the mentioned formulae which result at the level of the control structure in the correct functioning of the system. Actually, this is a false image, induced probably by the presence of the possible indeterminations in the mentioned structure formulae. The indeterminations decay the recipe “entropy-adjustment” into an infinity of possible ones, having as an effect the blocking of the approaches of an unconscious nature. The decayed recipes record a null psychological effort at the conscious level. This fact could be interpreted by the appearance of a doubled unconscious instance and by the suppression of the conscious instance. The psychological conflict appears at the control structure level which receives unspecific signals from the conscious instance and it will be charged with the task of the gratification of ungratifiable pulsing.

4.1. The Need for Psychological Stimulation as a Mechanism

How could the need for psychological stimulation be interpreted?

The existential equilibrium is dependent on the duality “generation-consumption”. The dominant role in the dynamics of the psychological status is fulfilled by the psychological behaviour, which is the observable form of the consumption of psychological potential. The presence of the generator of psychological potential is justified by the functionality of an intrinsic consciousness of the consumption which has to identify it. The existence of the generator of psychological states seems enigmatic because it should be justified by an external component of the mentioned duality, probably in the form of a conscience of consciousness. The generation and consumption of the psychological potential are dual elements of a system which maintain the forms of certain laws, with repeatability valences.

Surprisingly, the consumption seems to be endowed with mechanisms which allow the parallel functioning of the state corresponding to the extinction of pulsing signals and, more interestingly, of the state corresponding to the extinction of the potential state. Here, a special role is played by the mystic power of intrinsic consciousness, which changes the irrationality of the extinction of an unchallenged lack of balance into something materialized in desire.

What expresses this special kind of desire? The finality must overlap with a target image, having cathartic valences. The logic of the image – projection of finality type images is known by the producer (the unique consciousness) and not by the watcher (the simple consciousness). What seems to be the desire at the conscious level is the need at the unconscious level – as a dual image of desire.

The autonomy and the overall efficiency of the human psyche are explained through the interpretation of the surplus of psychological energy as a need for psychological stimulation. In this context the need for psychological stimulation seems to have a special role.

The equation (32) describes the dynamics of tensional states in which the whole (tensional) potential is used for specific processing determined by the psychological functioning. Generalizing the above equation by including the term “V”
which indicates an unused tensional potential, called the need for psychological stimulation, a complex calculus [12] leads to the conclusion that the need for psychological stimulation (per person) is constant!

5. CONCLUSIONS

The approach presented above leads to the following conclusions:

1. The psychological measures implied in tensional dynamics are governed by equivalence laws (since the obtained invariants are constant), which means that they have specific formulae which can be reproduced only by equivalences and not by breaking them! The cases of psychological pathology show up when the equivalences violate the safety limits of the psychological system. In this case the transitions of the equivalences non-equivalences associated with the lack of flexibility of the safety limits involves the psychological system in a perennial attempt of reconstruction of equivalences which can no longer be reconfigured;

2. Apperception is constant ($v = 1$);

3. The neuropsychological activation determined by a stimulus is positioned at the minimal level necessary for the activation of attention ($m = 1$), which supports the idea that the psychological system uses minimal energetic resources in the processing of stimuli;

4. Tensional states do not have amplitude ($b = 0$)! In other words, for the case $t_1 \neq t_0$, any tension is felt at the maximum level! This conclusion is valid only in the case of the blocking of defence mechanisms [1], [4] which are involved in tensional adjustment or in the case of their non-existence;

5. The functionality of psychological instances is governed by dynamic laws, all of them containing the same terms. The laws are different as to form and the existence of the common kernel of terms is explained by the necessity of the simultaneous functioning of psychological instances and by the maintaining of the invariant law of the unconscious instance. The invincibility of the unconscious [2] instance is determined by invariance law of the equivalence class type. The conscious instance, endowed with interpretive potential, presupposes laws which preserve the functionality of the unconscious instance. On the other hand the endowing of the conscious instance with rigid limits of potentialities, within which it can function effectively, turns this instance into an extremely vulnerable component. The maximum vulnerability of the conscious instance takes the form of deletion. The deletion is determined by the need of the psychological system to function with its natural unconscious instance in cooperation with a cloned instance;

6. The dynamics of the anti-entropy is determined by an inert component, manifested through the constant need for psychological stimulation; it is further determined by an active component which has to satisfy adaptation [1] to the inquirer environment. The conclusion is surprising because it shows that in the process of adaptation the psychological system does not use its whole available capacity. Moreover, the purpose of the inert component might be the stimulation or the inhibition of the inquirer environment. In this way adaptation becomes efficient;

7. Taking into account the conclusions presented above, we can conclude that an essential component of the psychological equilibrium is given by the preserving of the ancestral constant that is the need for psychological stimulation. The deletion of the possibility of the specific expression of a person and the impossibility of avoidance of the unpleasant state are determined by the alteration of the constant that is the need for psychological stimulation.

6. REFERENCES

TRADITIONAL AND MODERN IN TACKLING THE TECHNICAL PROBLEMS

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ABSTRACT: Tradition can be defined as a set of conceptions, habits and beliefs which are historically established within some social or national groups and which are orally transmitted from one generation to another, defining specific features for each group. The paper aims to analyze some traditional expressions and idioms and the correspondence of their significances with the actual technical or technological context and the actual development requirements. The increased exigencies concerning the insurance of the products high quality, high productivity and generally high efficiency show that new interpretations or significances could be given to some traditional expressions or even the applying of such traditional expressions could be disadvantageous in the modern context. The paper conclusions emphasize the necessity to adequate interpretation or adaptation of the traditional expressions in the actual stage of technological development.

1. INTRODUCTION

The situation of the industry throughout the last decades could be characterized by increased requests concerning the products quality, the work productivity, the product adaptation to the clients needs, production flexibility, promotion of the strategic objectives, customer satisfaction, market opportunities, ease of operation [7] etc.; the statement is essentially valid for the industrial products, but particularly for the products in the field of machine manufacturing. It is very clear that the nowadays client desires for himself a customized product, which fulfills entirely his desires and needs, is easy to be used and, furthermore, can be characterized by an attractive aspect.

Many of the above mentioned requests are included in the so-called concept of product quality; the specialists define the quality as the perception of the degree to which the product or service meets the customer’s expectations. The product is considered as having a high quality when it maximally corresponds to the customer requests.

Of course, such a significance of the quality concept is accepted by the Romanian citizen, but, along the time, affected by non convenient situations, the citizen also accepted products whose quality characteristics did not correspond to their expectations and the humor of the Romanian people often found ironic explanations for such situations.

On the other hand, nowadays Romania is member of the European Union and the problems of the product quality are tackled more and more serious, because the European Union imposes strict rules in this respect. As consequence of this new situation, sometimes it could be useful to analyze if the old ironic explanations remain or do not remain valid at present.

2. SUCCINCT EXPRESSIONS AS RESULT OF LIFE EXPERIENCE

The Romanian people found sometimes succinct expressions able to offer or to characterize in few words various life situations; the proverbs, the sayings or the idioms could be considered as some of these short expressions.

One can consider the succinct expressions as a vital part of the Romanian folklore, since they often provide a clear image on the life concepts or customs. In its turn, tradition can be defined as a set of conceptions, habits and beliefs which are historically established within some social or national groups and which are orally transmitted from one generation to another, defining specific features for each group.

The proverb is usually considered as an expression of folkloric origin and of extended use, which, in a concentrated and merely minimalist, yet suggestive content, includes a piece of advice, which may be the result of life experience [2, 5, 6].

The word proverb entered the Romanian language from the French language (proverbe), where it is in connection with the Latin word verbum (in English, word).

There is the general opinion that proverbs reflect the wisdom and the mentality of a certain people. It is therefore possible that when Mihai Eminescu defined the folklore as “the shortest expression of the feeling and thinking”; he was especially referring to proverbs.

If one analyzes the topics of the proverbs, one can find that the statistic analysis of 5994 proverbs shows [5] that 24.25 % of them tackle aspects concerning wisdom, 17.40 % - irony, 7.70 % - work, 6.94 % - cautiousness, 4.82 % - intelligence, 4.42 % - justice, 3.58 % - education, 3.57 % - dignity, 3.24 % - kindness, 3.15 % - knowledge, 2.90 % - chance, 2.60 % - truth, 2.40 % - honor, 2.40 % - thrift, 2.14 % - friendship, 1.90 % - valiance, 1.86 % - humanity, 1.63 % - beauty, 1.55 % - resignation, 1.20 % - respect, 1.04 % - economy, 0,97 % - fate.

Herbert Simon [16] justified the proverbs quotability by the fact that they almost occur in mutually contradictory pairs.

One can say that proverbs offer a comprehensive image on the conception of the people about the world, about the national specific traits, about the moral principles in general.

The saying (in Romanian, zicătoare, or zicere) is a category of popular etymology, similar to the maxim, which sometimes is in verse and which often expresses a remark of general or philosophical use, or a principle, or a rule of conduct etc. The origin of the Romanian word comes from the Latin word dicere (saying).
The maxim is sometimes regarded as a certain type of proverb or saying; under other circumstances it is referred to as a distinct concept, meaning a concise statement, expressing a rule of contact, a logic or methodological statement. The word maxim is derived from the Latin word maximus, which means greatest. In English, the maxim is considered as a principle or a rule, or just a wise saying, especially intended to advise or recommend a certain course of conduct. There is the appreciation that the concept of maxim stresses out the brief formulation of an ultimate truth, a fundamental principle, or a rule of conduct [10].

3. DIFFERENT ATTITUDES IN FRONT OF LOW QUALITY PRODUCTS

If somebody examines the attitudes of the people / technicians in front of a new product, one may observe several distinct situations (fig. 1). Thus, if the product corresponds to the quality request, all the people are content and sometimes this good quality is a matter of pride. Of course, the product could be of normal quality or of high quality, in the latter case this meaning high service duration, ease to use etc.

A well-known fact, the product is the result of a short or a long technological process. If one considers the work process as a system, one can find that there are input factors (the mechanical drawings of the parts to be achieved, the types of workpieces, the available machine tools, the workers qualification etc.), output factors (the product cost, the work productivity, the product accuracy, the product materials properties etc.) and disturbing factors. If the input factors are generally known and controllable, the disturbing factors could be less known and frequently enough they are not or are incompletely taken into consideration when the new technological processes are applied. From the output factors, in this paper only the product quality is considered.

If the product is characterized by low quality, the attitudes could be different.

A first such attitude could be an attempt to justify that low quality is a normal fact; the worker or generally the specialist in the field of technology could even try to exonerate himself, “throwing” the guilt on other persons with responsibilities in obtaining a product of acceptable quality.

The second attitude could be of resignation; the specialist accepts that the product is of low quality, yet he does not adopt an active position, trying to search and find the causes of the product’s low quality.

The third situation corresponds to the specialist who accepts that he is responsible for the low quality of the product, but just as in the former case he does not try to search and find the causes which generated this situation.

A fourth situation would be for the specialist to be aware and accept at least in part that the guilt for the low quality of the product belongs to him. This specialist will genuinely try to thoroughly analyze the causes of the low quality, to find the factors that generated the low quality and to adopt solutions so as to avoid repeating this situation in the future. Probably, this specialist is able to have a flexible attitude and to conveniently solve the difficult problems specific to the situation when low quality appears. Furthermore he is bound to develop his professional skills up to the point where hardly any mistakes at all will be made. In fact, if one is to analyze all of the above-mentioned situations, this last one is probably the most desirable attitude a person could adopt in tackling with the low quality of the products, since it not only implies sense of responsibility, but also desire of (self)-improvement.

Almost all of the attitudes briefly analyzed above are reflected in at least one corresponding proverb, saying or maxim, which actually proves once again that folklore wisdom is a result of life experience, mirroring in fact real-life situations.

4. CONCORDANCE BETWEEN THE SUCCINCT EXPRESSIONS AND THE TECHNICAL OR ECONOMICAL REQUESTS

The authors of this paper intended to consider and analyze the way some sayings, proverbs and phrases used sometimes in the technical or economical context are perceived nowadays [1, 3, 4, 8, 9, 12].

![Figure 1. Different attitudes reflected in proverbs, sayings and maxims](image-url)
When a product is finished and some technical conditions are not adequately fulfilled, but the “creators” of the product appreciate that the product could work even in such a situation, they say: “it shall work anyway” (“șa meargă oricum”). It is known that along the history and the industrial evolution, in Romania many “improvised” solutions were used and these “improvisations” were appreciated. Quite often Romanian citizens solved difficult problems by combining surprising elements and interesting enough they were actually praised and admired for the results of their actions and subsequently for their so-called ingenuity or inventive spirit; the Romanian citizen considered such solutions as a proof of their high creativity and originality. But in the field of industrial products, technical requirements are often highly strict and any deviation from the prescribed conditions is considered unacceptable. Ingenuity and originality therefore are not desirable in such a context, where the sometimes too-often-used improvisations could lead to surprising results, yet from a negative point of view. Indeed creativity is an asset, including in the field of technology, however when it comes to obeying and applying specific requirements, it may simply be in the way.

For this reason, the significance of the saying “it shall work anyway” must be reconsidered; if the technical requirements are high, the acceptance of the validity of the expression “it shall work anyway” could lead to negative results and to a negative appreciation of the worker/technician/engineer who uses and promotes it.

Apparently in contradiction with the above mentioned saying, one can mention the saying “it either works, or not” (“ori merge, ori nu merge!”); this saying intends to emphasize that there is no such thing as a third solution (the third way to solve the problem); in other words, it either works like this, or it doesn’t – no other solution is to be accepted.

The necessity to make an immediate decision for the product quality is specific to the activity of the quality inspector; by examining the product, in short time the inspector has to come up with the decision whether to accept the product or not. He is the director of a company. The negative nuance of this saying requires therefore no further explanations.

Somewhat in connection with the saying “Don’t put off until tomorrow what you can do today”, one could also mention the expression “Put off, put off, maybe the problem will solve by itself!” (in Romanian, “Nu lăsa treaba de azi pe mâine, las-o pe poimâine!”). This addition changes the meaning of the saying entirely – instead of being an impulse to solving things in their due time, it rather implies in this new form a state of laissez-faire. Originally this saying was apparently considered the expression of the fight against bureaucracy (hoping that the day after tomorrow the task will be simpler or will even disappear), nowadays however accepting such a solution could not be regarded as positive, if the problem to be solved today must absolutely be solved today.

An apparent contradiction with the saying “Do not put off until tomorrow what you can do today” could exist in the saying “Night is a good counselor” (in Romanian, “Noaptea este un sfetnic bun”); but, in this case, the situation is characterized by profound differences. The saying “Night is a good counselor” can be applied in the situations when the intense activity of solving a difficult problem did not lead to an acceptable solution. It is obvious that the problem-solving activity could need a high technical or managerial creativity; in this direction, when an intense activity of finding a solution did not lead to the expected result, a method for the creativity stimulation which is genuinely recommend is to take a break and change the activity, so as to offer a moment of rest to those areas of the brain involved in finding solutions. And the history recorded such cases when for problems which seemed hopeless at first, a solution was found the following day, when the brain sometimes provided highly unexpected and adequate solutions. The explanation is found in the fact that, as it is known, some thinking processes develop out of the state of awareness, consequently including when the human being sleeps. The direct result of this activity of a certain area of the human brain can be a surprising and incredible identification of the desired solution.

The self-critical attitude to work could be identified in a short history concerning the number of situations when the worker
can offer wrong products. The genuine trend to postpone making an immediate decision is somehow mocked at by the answer: “For us, a worker can make the same mistake three times; the first time he receives a warning, the second time, his salary is reduced and the third time he is fired”. By comparison the answer of a specialist from a developed country is brief and to the point: “For us, the worker can make a mistake only once, because the second time he no longer works for us”. This short story suggestively emphasizes the exigency necessary to evaluate the own activity, the necessity to obey the technical regulations and to offer only products of high or at least of acceptable quality.

On the other hand, the short story is totally in accordance with the significance of the Romanian proverb “He who makes mistakes, pays for them!” (in Romanian, “Cine greşeşte, plăteşte!”).

In the case of a mistake (a product which does not correspond to the technical requirements), there are different manners to “justify” the appearance of the mistake, to find an excuse for a product of low quality. The worker says: “We’ve always worked like this!” (in Romanian, “Aşa am lucrat întotdeauna!”) or “All of us make mistakes!” (in Romanian, “Toţi greşim!”), or “The situation is not so bad!” (in Romanian, “Nu-i chiar aşa de rău!”) or “Where one works, one may make mistakes!” (in Romanian, “Unde se munceşte, se şi greşeşte!”). It is obvious that such answers, such explanations and such attitudes to the product with errors or of low quality could not be considered as acceptable. This “tradition” is not adequate and the engineer has to make the workers / the technicians / the foremen realize that achieving products of high quality is of utmost importance.

A bad “tradition” is also very well suggested by another short anecdote. Let one consider a dialogue between two workers, a Romanian one and a Japanese one. They address each other questions about their jobs. The both agree on the fact that their daily working time is of 8 hours. When asked why the daily working time includes 8 hours, the Japanese worker says that he works four hours for his salary, two hours for his company and two hours for Japan. The answer of the Romanian worker was “To us, the situation is pretty similar; I work four hours for my salary, two hours for my company and I don’t care in the least about your Japan!” (in Romanian: “La noi, este la fel ca la voi. Eu lucrez 4 ore pentru salariul meu, două ore pentru companie, iar de Japonia ta mă doare în cot!’”). What one notices from this short anecdote is the tendency to inadequately use the entire amount of time devoted to work; sometimes, bad habits urge the worker to shorten the work program or just to waste the time.

5. CONCLUSIONS

The actual evolution of the industrial production could be characterized by the high attention directed to the product quality. The normal development of the product must ensure that the product obeys a set of prescribed quality requirements, despite the disturbing factors that may decrease the product quality. Specialists in the field of technology adopt different attitudes towards the low quality products and subsequently towards the responsibility for such a situation. Along the time, the attitudes were reflected in the proverbs, sayings and maxims; such short expressions can be considered as part of the national folklore. Some of these idioms or even short stories often provide an ironical image concerning the position of the specialists confronted with the low quality of the product. What is important and should be emphasized is that in the present-day context, such expressions and sayings should be regarded merely as having a certain linguistic value. In other words, when it comes to concrete situations, sayings as the ones analyzed in this paper should be considered unacceptable. Even though tradition defines a people, and such proverbs and sayings are a vital part of this tradition, the engineer of today for example, being the first responsible for the quality of the product, has to find adequate solutions to correct the attitude of his subordinates and avoid employing such expressions as excuses for work inadequately done.

6. ACKNOWLEDGEMENTS

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4. * * * The small encyclopedic dictionary (in Romanian), Editura Enciclopedică, Bucureşti, Romania, (1972).
ASPECTS OF SCIENTIFIC AND TECHNOLOGICAL CULTURE AT STUDENTS IN TECHNICAL SCIENCES

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ABSTRACT: The aim of this paper is to identify the attitudes, knowledge, and behavior of young people, students of a technical university towards science and technology. Methodology: The survey was conducted on a population of 124 students from different faculties of a technical university. The questionnaire used followed: the degree of interest and information for science and technology, used source of information, leisure scientific practices as well as scientific knowledge and technical skills. The results obtained show the strong points and vulnerabilities in terms of scientific and technical culture of the current students, future specialists in science and technology.

1. INTRODUCTION

Developing an information society involves above all the formation of a technical and scientific culture throughout the society. Although to achieve this, time and money have been invested and the researches on technical and scientific knowledge have stressed unsatisfactory results that have generated intense debates on the scientific board of education.

Following these results a series of measures on how to acquaint more people with science and technology, fostering science education in schools and cultivate a scientific spirit among young people have been taken.

Jean-Yves Cariou (2007) considered that for the development of science growing scientific spirit is extremely important, by placing students in situations that allow the free education initiative in the scientific approaches.

Dominique Vinck (2007) consider that the key element in the dynamics of science is in fact the connection between science and society, and as researchers and teachers should deal more than social mechanisms leading to the development of science than a rigorous training of students in sciences.

Taking into account that academic success is mediated by environment and personality factors such as conscientiousness (D. Pasquier, CAMazilescu, 2009), in developing science education should be taken into account at the same time, and individual aspects of people trained (knowledge, attitudes etc.), but also the social mechanisms leading to the development of science.

Investigation of technical and scientific culture entails taking into consideration the size of both societal and individual size. Societal dimension refers to the scientific and technical development of society, while individual dimension refers to the range of thoughts, experiences, knowledge, skills and behaviours towards science and technology (Albert, Marchal & Robitaille, 2002).

In this paper we refer only to the dimension of individual scientific and technical culture following assessing students’ attitudes towards science and technology.

2. METHODOLOGY

The survey was conducted on a population of 124 students from different faculties of a technical university.

The questionnaire used (produces by Mathieu Albert, 2002) followed:
- the degree of interest and information for science and technology,
- used source of information,
- leisure scientific practices
- scientific knowledge and technical skills.

Investigated students (58 girls and 66 boys) come from 4 technical faculties (AC, Architecture, Construction and Mechanics). For two of these faculties student’s selection in 1st year was done with a knowledge-based assessment and the other two faculties have been recruited on the basis of a personal folder (with results of secondary school).

Investigating students have knowledge of a foreign language. Specifically situation known languages is as follows: 41 students only have knowledge of a foreign language (French, English or German), 64 students knowledge of two foreign languages (French, English, German, Italian, Spanish, Russian or Serbian) 18 students knowledge of three languages (French, English, ..., Hungarian, Slovak, Japan), 1 student - connoisseur of four languages (English, French, German, Spanish).

3. RESULTS

3.1. The degree of interest and information for science and technology

Level of interest and information has been investigated in relation to 5 topics of general interest: science and technology, sports, culture, politics, economics and finance.

Analysis of global responses shows that students from UPT considered that they are rather interested in the field of information sciences and technology (62.10%), sports (54.84%) and culture (55.65%), and less information in economy (21.77%) and politics (22.58%).
Perception of the level of information in 5 areas of interest

Figure 1. – Representing the level of information in science and technology, culture, sports, politics and economics

Representing the level of information in science and technology according to the specialty faculty followed is as follows (table 1): Students from AC are considered well informed in science and technology (80%), considering to be twice as informed than those in construction (46.7%).

Table 1. The information charged depending on faculty specialization

<table>
<thead>
<tr>
<th>Faculty</th>
<th>rather uninformed</th>
<th>rather informed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automation</td>
<td>20.0%</td>
<td>80.0%</td>
</tr>
<tr>
<td>Architecture</td>
<td>43.8%</td>
<td>56.3%</td>
</tr>
<tr>
<td>Construction</td>
<td>53.3%</td>
<td>46.7%</td>
</tr>
<tr>
<td>Mecanique</td>
<td>34.4%</td>
<td>65.6%</td>
</tr>
</tbody>
</table>

Regarding the perception of the level of information in science, technology and economy there are not notable differences between girls and boys. Gender difference makes its presence felt in the perception of the level of information in “politics” (χ = 8.89, p <0.05) and “sport” (χ = 5.92, p <0.05), areas in which the boys feel better informed than girls, but also in the field of “culture”, in which girls feel more informed than boys (χ = 7.07, p <0.05).

Figure 2. Representing the level of information depending on the gene of respondents

Regarding the interest for the areas listed above, students manifested the greatest interest to science and technology (87.90%), culture (76.61%) and sports (66.94%) and less to the economy (46, 77%) and politics (24.19%).

Table 2. Interest charged on science and technology, culture, sports, politics and economics

<table>
<thead>
<tr>
<th>Area</th>
<th>rather uninterested</th>
<th>rather interested</th>
</tr>
</thead>
<tbody>
<tr>
<td>science &amp; tech</td>
<td>12.1%</td>
<td>87.9%</td>
</tr>
</tbody>
</table>

Science and technology is the area to which students manifest the greatest interest, regardless of specialty faculty followed.

Thus, the proportion of students interested in science and technology is the following: 96.7% for Automation, 93.8% in Architecture, 81.3% to 80% and Mechanics in Construction

Figure 3. Comparative representation of the level of interest and information

For all fields taken in the analysis the interest is higher than the level of perceived information. The largest spread between the interest and the information is observed in the economy, where interest perception is twice higher than the perception of information. On the opposite side is the policy, against which the interest is approximately equal to the information.

Table 3. The interest charged depending on the type of respondents

<table>
<thead>
<tr>
<th></th>
<th>science &amp; tech</th>
<th>sport</th>
<th>culture</th>
<th>politics</th>
<th>economy</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>89.66</td>
<td>58.62</td>
<td>89.66</td>
<td>13.79</td>
<td>41.38</td>
</tr>
<tr>
<td>B</td>
<td>86.36</td>
<td>74.24</td>
<td>65.15</td>
<td>33.33</td>
<td>51.52</td>
</tr>
</tbody>
</table>

Regarding the interest shown for the 7 research subjects proposed is respondents observed that the Internet (80.65%) and medium (79.84%) interested most of the students. In the hierarchy of interest’s Politehnica University of Timisoara students, after internet, environment is medicine, astronomy and nanotechnology and then the last places genetics, economics and social sciences.

Table 4. Interest charged on scientific topics

<table>
<thead>
<tr>
<th>Subject</th>
<th>rather uninterested</th>
<th>rather interested</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medicine</td>
<td>41.94%</td>
<td>58.06%</td>
</tr>
<tr>
<td>Environment</td>
<td>20.16%</td>
<td>79.84%</td>
</tr>
<tr>
<td>Internet</td>
<td>19.35%</td>
<td>80.65%</td>
</tr>
<tr>
<td>Genetics</td>
<td>51.61%</td>
<td>48.39%</td>
</tr>
</tbody>
</table>
Stimulate interest in assessing students for science and technology questionnaire included 3 factors: family, school and media.

Analysis of students’ responses shows that the school is to be appreciated as the factor with the largest involvement in stimulating scientific interest (38.35%), followed closely by the family (33.73%) and least by the media (27.71%).

![Figure 4. Representation of factors involved in stimulating interest in science](image)

Implications of development of science in everyday life of man is one of the points of dispute concerning the granting this domain. Considering the benefits and effects of the impact of science on human life most students (82.3%) estimated that it brings more good than bad, being confident in the development of science.

![Figure 5. Allocation of science impact on human development](image)

Results from this item aren’t much different on what concerns the gender of respondents here were obtained notable differences between AC students and Mechanics (χ²=18.67; p<0.05) in a sense that the number of the students from Mechanics think that science does man worst than better is 5 times larger than the ones from AC respondents.

![Figure 6. Representation of preference for sources of scientific information](image)

### Table 5. Perception of the impact of science on human development according to the college students investigated

<table>
<thead>
<tr>
<th></th>
<th>%AC</th>
<th>%Arh</th>
<th>%Cti</th>
<th>%Mec</th>
</tr>
</thead>
<tbody>
<tr>
<td>more bad</td>
<td>6.7</td>
<td>12.5</td>
<td>16.7</td>
<td>34.4</td>
</tr>
<tr>
<td>more good</td>
<td>93.3</td>
<td>87.5</td>
<td>83.3</td>
<td>65.6</td>
</tr>
</tbody>
</table>

In regard to sources of information and scientific technology, television is the preferred media by students -followed by magazines and newspapers of general interest, the popular scientific magazines and radio.

![Figure 7. Representing scientifique loisir depending on the motivation](image)

### 3.2 The Scientific loisir

Loisir the science is practiced by around 48.4% of the students investigated. Gender and school variables that follow are not influenced significantly by the practice or not a scientific loisir

Disciplines which circumscriu practices loisir Scientifically most wanted are: IT, electronics, mathematics and human sciences. On the opposite side was ornithology, zoology, botany and gardening to keep students who manifest an interest or very low.

Opportunity to acquire new knowledge through a scientific practice of leisure is considered to be an important reason for 68.59% of the students investigated. Similarly, a large number of students (65.51%) consider the scientific loisir a pleasant way to occupy their time. To carry out these activities in the family or to meet people with the same interests is an important reason for 38.7% of subjects.

![Figure 8. Representation of scientific impact on human development](image)

### 3.3. Technical competency

Another aspect investigated in this research is the technical skills. Information provided by the questionnaire revealed that the actual skills of the students in terms of technical expertise. Measuring technical skills allow us to comparisons between different segments of the population investigated, such as differences between boys and girls or between students from different faculties.

By competent technical skills we understand the various technologies used in everyday life. Appliances are chosen as indicators of the video, computer and ATM. To mitigate a possible bias associated one of the devices used to calculate an index derived from combining the answers on the use of the 3 technologies presented above.
Overall, our results show that no statistically significant differences between the technical skills of students from different faculties, nor between boys and girls. University hierarchy based index calculated for the technical skills look like this (table 6):

Table 6. Media indices technical skills depending on college students investigated

<table>
<thead>
<tr>
<th>Rang</th>
<th>Faculty</th>
<th>Construction</th>
<th>Mecanique</th>
<th>Automation</th>
<th>Architecture</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>63,10</td>
<td>58,33</td>
<td>60,27</td>
<td>57,59</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>60,27</td>
<td>57,59</td>
<td>63,10</td>
<td>60,27</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>58,33</td>
<td>57,59</td>
<td>63,10</td>
<td>60,27</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>57,59</td>
<td>60,27</td>
<td>63,10</td>
<td>58,33</td>
<td></td>
</tr>
</tbody>
</table>

Analyzed separately each item proposed for assessing technical skills, can make the following remarks:
- 94.4% of students use the ATM to withdraw cash;
- A third of students use the ATM for cash or deposit to pay various bills.

The calculator is used in proportion of 95.2% of students for:
- Seeking information on the net (96.8%);
- Send and receive email (96.8%)
- Buy products/services via the Internet (45.2%)
- Download files or programs from the Internet (93.5%)
- Participate in discussions on the internet (81.5%).

Results were obtained to investigate the use of video for recording of TV (only 12.1% of students used the video)

3.4. Scientific knowledge

Measuring scientific knowledge involves calculating an index obtained by summing quotas on 16 items. From the analysis results can be observed the following:

- The type of participants is not a factor differentiated on scientific knowledge, so there are no notable differences between girls and boys. However, the assessment of scientific knowledge the girls get a little bigger index than boys (69.61 for girls to 64.39 and boys);
- No significant differences between students from different faculties. Hierarchy indices scientific knowledge on the 4 faculties is as follows (Figure 8):
  \[ \text{I}_{\text{st}} \text{(Arh)} = 72.26; \ I_{\text{st}} \text{(Ct)} = 67.92; \ I_{\text{st}} \text{(AC)} = 66.87; \ I_{\text{st}} \text{(Mec)} = 60.35 \]

With all the foreign language is not a known variable differentiator owned scientific knowledge, we present in the figure below results:

Figure 9. The indices of scientific knowledge based on the number of foreign languages known

For examples difficulty items used in the evaluation will present scientific knowledge, still, a few examples: ‘Convergent laser works by sound waves? ‘, ‘Antibiotics kill both viruses and bacteria ‘,’ electrons are smaller than atoms? ‘. etc.

4. CONCLUSIONS

Technical University students in survey are very interested in looking at scientific issues and technology and also consider and advise in this area.

Results show that students from the Automation (AC) are considered to be the most interested and informed in the field of science and technology. But this perception of their results is not confirmed by evaluating scientific knowledge and technical skills.

Thus, the best results in terms of their technical skills were found to the students of Construction and the best results in terms of scientific knowledge to the students of Architecture.

Differences between the perceived level of information and knowledge held were obtained in the case of assessments made by the girls and boys.

Boys and girls are estimated to be informed and interested in science and technology. Boys in proportion of 65.2% are considered to be well informed, and the proportion of girls is 58.6% estimated to be well informed of the science. After the evaluation is observed that the girls have got better results than boys at scientific knowledge and technical skills (although not statistically significant differences existed in any of the conditions listed above).

The results of these assessments show the important role that school plays in the development of scientific and technological culture. Besides the school there can not be ignored nor the family, the media and leisure scientific activities.

5. REFERENCES
ABSTRACT: One of the most interesting philosophical aspects regarding engineering education refers to the understanding of the relation between scientific theories and the characteristics of nature they describe. Because he is focused on applying the scientific theories on the real physical world, the engineering student has the tendency of considering those theories as being “true” once forever. A closer look to the structural features of the scientific discourse could reveal a much more complex image. A continuously evolving science is trying to reveal the most significant characteristics of reality. The engineer is invited to exploit them and doing so, he has the possibility to discover the limits of the epistemological optimism of the scientific discourse. He has the opportunity to observe the complex mixture between the qualitative and quantitative aspects of scientific concepts and the very refined dynamics of scientific representations, a process we analyse using the concept of “descriptive imaginary”. Therefore, we propose a wider point of view regarding scientific theories in engineering education and a new method of teaching them.

1. INTRODUCTION
Modern science represents one of the most important cultural activities that influence a lot many aspects of human existence, including the evolution of mentalities. However, there is a common feature of the applied science discourse and of the theoretical science discourse that raises some questions regarding the development of students’ mentality concerning the nature of scientific theories. This feature, which interests us a lot, is the non-historical character of the scientific discourse, at least in universities and high schools. On one hand, this non-historical character of the scientific discourse gives some advantages to the professors, as regarding the communication efficiency. Of course, it is much more convenient to avoid the huge amount of historical details when one has to transmit information about a knowledge system in a short time. [1]

In addition, this attitude allows the professor to choose the newest and the most efficient scientific theories and to present them to the students in order to help them to connect themselves to the freshest scientific problems of their time. On the other hand, there are some negative aspects induced by such an attitude and theirs consequences regard not only the students, but also the public.

Quite often, science becomes a sort of myth for common people and scientific representations are seen as definitive descriptions of the capacities of nature. [2] Because the dynamics of these representations is ignored, they are considered also complete descriptions. Therefore, the scientific values cultivated by the scientist in designing scientific theories are mixed in the contemporary popular culture with religious and moral values. For many people the success of science became legendary and its authority has no limits, even in the moral area of human existence.

2. MORAL NEUTRALITY OF SCIENCE
Philip Kitcher observes that “legend celebrated scientists, as well as science. The noble goals of science have something to do with the attainment of truth. Here, however, there were differences among the versions of Legend. Some thought in ambitious terms: ultimately science aims at discovering the truth, the whole truth, and nothing but the truth about the world. Others preferred to be more modest, viewing science as directed at discovering truth about those aspects of nature that impinge most directly upon us, those that we can observe (and, perhaps, hope to control). On either construal, discovery of truth was valued both for its own sake and for the power that discovery would confer upon us.” [3]

Because science is characterised by moral neutrality and because the scientific theories are presented in schools and universities in a non-historical manner, the contemporary popular culture is characterised too often by moral neutrality and very few people’s poses historical consciousness as to their culture and their identity. Most of the people have no direct access to the understanding of the significance of scientific theories but through technology. Technological approach of science is an indirect one and creates the illusion of complete stability and efficacy of scientific descriptions of nature capacities and this problem appears in many technical schools and technical universities. Actually much of the theoretical evolving struggle in science does not appear at all in the evolution of technology.[4] Moreover, if a certain technology uses some capacities of nature this does not mean that scientific theories used to create that specific technology represent a complete description of those capacities of nature. For example, the construction of the atomic bomb is not an argument for considering the models of atom used in this process as being complete descriptions of the atomic physical structures. Since 1945, those models evolved continuously, but the construction of the hydrogen bomb, which took place later, reflects only a small part of this evolution.

All the aspects mentioned above are consequences of the fact that students and common people as well are not used to pay enough attention to the evolving process of scientific concepts, which always have a historical evolution and sometimes a cultural background that reveal their true ontological nature and their descriptive character, with its virtues and limits. [5] In addition, perhaps more important, the provisory and dynamic character of scientific truth can be revealed by investigating the dynamics of scientific discourse, the evolution of scientific theories and scientific concepts.

3. DESCRIPTIVE IMAGINARY AND MODERN SCIENCE
Because the dynamics of scientific discourse is a complex subject, we are going to introduce some conceptual instruments that could help us to understand better the ontological status of
scientific concepts, which are interrelated inside of a scientific theory.

In everyday language, we use to oppose quite often the words “imaginary” and “real”. It is very convenient to suppose that it is possible to make a very sharp distinction between “real things” and “imaginary things”, even though human knowledge derives from a combination of these two categories at the conjunction of human imagination and human cognition with that part of the physical real detectable by our senses.

Western culture is quite suspicious regarding any imaginative excess, especially in the moments when imaginary interposes between human consciousness and the physical world. Those situations are usually associated with psychopathology. This circumspection could be explained by the long time in which Western civilisation struggled to eliminate mythical imaginary from the dialogue of human consciousness with nature. In a way, this process was similar with the dissolution of the charm of mythical explanation regarding the world.

Some of the greatest cultures in the world missed the opportunity of inventing modern science just because they hesitated to make a sharp distinction among real world and imaginary worlds. Indian culture is a good example in this respect. [6] One can easily conclude that, in order to give constructive powers to human imagination in the knowledge making process, a great culture has to admit the fictional nature of the conceptual products of human imagination. The distinction between imaginary (as a noun) and real (as a noun, also) represents the first step towards the recognition of the constructive and epistemological function of imaginary. This is equivalent with admitting that descriptive fictions have a provisory and explanatory nature with regard to their part in the scientific discourse.

In spite of some very important and remarkably early achievements in mathematics and empirical medicine, far-eastern cultures were not able to get rid of mythological imaginary in explaining the world. Consequently, they did not develop a methodology for the optimisation of the world descriptions according to some pragmatic criteria. Unable to distinguish descriptive fictions from mythological fictions, they also missed the opportunity to develop a proper descriptive imaginary as part of the scientific discourse about the physical real. As to the European culture, it has been characterized by a great competition between mythological descriptions of the physical world and logical-structural descriptions of the same physical world. At the end of the XVII-th century, the logical-structural descriptions, based on logical-structural fictions, prevailed upon mythological descriptions. They proved to be more efficient, so – finally – descriptive imaginary prevailed in this culture upon mythological imaginary.

To describe this very complex process represented by the raise of descriptive imaginary in western culture, we could use different disciplines, starting with structural anthropology of Claude Levy-Strauss and ending with modern neurophysiology, since imaginative conceptual structures with descriptive features lay very often between conscious mind and unconscious mind, between rational and irrational, between individual and cultural. For the moment, we will try to emphasize some of the features of descriptive imaginary and to understand its constructive role in the scientific discourse.

One of the most distinctive features of descriptive imaginary is represented by its intentional rationality. The descriptive fictions are the products of the use of human reasoning in the limits of rationality. Human imagination is not used in a very free manner, but rather in a selective way. The conceptual products of it have to meet a very tough criterion. They have to fit one to the others in such a way that the final result, the scientific theory should have internal coherence. Moreover, the image of reality created by the theory must be a testable and a believable one.

A good example for understanding the specific difference between mythological imaginative scenarios and descriptive imaginative scenarios is a comparison of the mythological description of a dragon with a scientific description of a pterodactyl in a museum. Many representations of the dragon pay no attention to the proportions of the animal. Especially the head is sometimes far bigger than the wings. So big is the difference that suddenly becomes obvious that such a creature could never fly. However, this aspect has no importance in mythological discourse and simply does not undermine the power of the mythological descriptions. On the contrary, in the scientific description of a pterodactyl, the lift of the wings plays a major role and the proportions of the animal are taken very carefully into consideration in order to produce a plausible description of a flying animal.

Among other pragmatic criteria, the one of the concatenation of descriptive representations is the most important. It demands that each concept with descriptive function within the framework of a scientific theory must fit in the conceptual puzzle of that theory in such a way that leaves no dark places in the description of the real phenomenon. The concept must be logically linked to other central concepts of the theory in order to assure a minimum efficiency for the scientific description, therefore the concept is shaped in accordance with the whole theory. This feature distinguishes the scientific discourse in comparison with other types of discourse. For example, electromagnetic induction has to be understood in such a way that fits with other important concepts in electromagnetism like field or energy.

However, sometimes, human mind is forced to go beyond the limits of classical logics in order to be able to properly represent the real. This is the case for some important scientific hypotheses like quantum hypotheses of Planck, the relativistic hypotheses of Einstein or the hypotheses of complementarity developed by Niels Bohr.

4. FICTIONAL NATURE OF SCIENTIFIC CONCEPTS

The reason for the complexity of scientific representations dynamics is the complex relation between fictional products of human thinking and what we are used to call objective physical reality. Scientific theories can be seen as complex systems of such fictional products of human thinking with descriptive features toward physical reality. Especially contemporary theories in physics create a whole explicative world of concepts called “scientific reality” involved in a very complex relationship with “objective physical reality”. That is why we are going to rename those two concepts. We will call “scientific reality” just “reality” and we will consider it as being a sort of coherent image of “objective physical reality”. As to this last one, we will call it “real” and for us it will represent the natural environment whose properties and capacities can be partially described by the human thinking using conceptual structures called descriptive scientific representations and descriptive laws of nature. Human thinking generates the scientific reality as an image, or a coherent description of the accessible part of the physical real.
The major problem of the relationship between scientific reality and physical real is represented by the fact that scientific reality is not unique, nor the set of premises used in its construction. That is why recent struggles in the unification of contemporary physical theories are so important. They represent a last step in a historical evolution of basic scientific descriptive concepts in natural sciences towards a final and coherent description of the capacities and human understandable features of nature. Nevertheless, this type of description can never become a definitive one, because the relation among human thinking, scientific reality and physical real is an evolving one.

After all, the development of modern science determined an evolution of scientific representations. At the beginning of human rational inquiries upon nature these representations were mainly qualitative-sensitive. In contemporary science they became predominantly conventional-structural. Their visuality (their capacity of helping the scientist to visualise physical processes) changed and became, little by little, a conventional-structural one.

This giving up of sensory intuition simultaneously with a translation towards mathematical abstraction in the historical development of scientific discourse revealed another important aspect concerning scientific representations. Theirs ontological status in the discourse depends on the distinction drawn between the objective physical process and its reflection in the scientist mind.

Descriptive fictions are products of human imagination, but in the course of scientific theories development are treated as if they were in perfect conformity with the characteristics of nature they describe. [7] This kind of provisory ontological status inside of scientific discourse allows the scientist to develop complex reasoning systems based on these descriptive fictions and to test the predictions of such systems as regard testable behaviour of physical systems. Some of these fictions are shaped in such a way during the process on confrontation with experimental results that allows them to remain valuable descriptive “prototypes” of real objects. Others become more and more obsolete and tend to lose the competition for the status of truthful descriptions, as was the case with the concept of ether.

No matter how successful some of these descriptive concepts are, their fictional origin must be emphasized for their real nature to be well understood. Their truthfulness is essentially a provisory one and in time their shape or properties could be changed or, in a more drastic case, they could be entirely replaced by other concepts.

Very few professors and students become aware of the fact that the engineer is in a very epistemologically interesting position, because he is a witness to the interaction of theoretical scientific products with practical experience. Therefore, we propose a wider point of view in teaching engineering, a point of view that underlines the dynamic character of scientific products, being those concepts or theories. In addition, such a manner of presenting scientific predictions could allow students to become fully aware of the provisory character of scientific truth, in the sense of a continuous improvement of the precision of descriptions, models and predictions.

5. CONCLUSIONS

One of the most competent specialists in the problem of physical realism, Bernard D’Espagnat, describes briefly this evolution. “Because scientific knowledge has a kind of certainty – at least a relative one – which distinguishes it from conjecture pure and simple, anyone who deems the thesis of physical realism to be well-founded should expect physics to produce increasingly general theories and should also expect these not to be enduringly in conflict one another. In each field there should therefore remain just one such general theory, once the short-lived period of trial and error is over and it should be possible to formulate these general theories as descriptions of reality. This latter condition can also be expressed by saying that the general theories in question must be capable of being stated in terms of strong objectivity.” [8]

Beyond these aspects, the dynamics of scientific representations is highly influenced by their mixed configuration. Each one of them has a public part and a private part. Although the raise of a scientific theory and the acceptance of its validity inside of a specific scientific community have to do primarily with the public part of scientific representations, the private part of them must not be neglected. It plays a very important part in the process of manipulating representations by different individuals. In the language used by Gottlob Frege, we can say that beyond the sense associated to a specific scientific representation in scientific community, each individual attributes a specific significance to that representation, which allows him to manipulate it better in his own mind.

One of those who noticed this conflict between the public and objective part of scientific discourse and the private, qualitative and sometimes intuitive part of it was Gerald Holton, in his book Thematic Origins.

The understanding of this dynamics can be obtained only through an historical inquiry upon the evolution of natural sciences. Moreover, here we face the most difficult problem this paper refers to. In the traditional manuals natural sciences are presented in a non-historical manner. As we already mentioned above, this kind of attitude has its own benefits.

First, it allows students to become directly familiar with the newest form of the central scientific theories in the specific field of investigation. Second, the attention is focused upon the scientific informational content, and not upon the historical acquiring of information. Third, the argument of historical authority is elegantly avoided and the gate is open for further improvements of the main theories.

On the other hand, this non-historical presentation of the scientific theories creates a false impression about scientific representations as being static ones. Even the understanding of some fundamental concepts suffers because pupils and students are told how to use these concepts, but have no idea about the way these concepts appeared and evolved, about the deep reasoning that stands at the bottom of their birth.

That is why we consider the adopting of new historical strategies in teaching natural sciences in engineering education as being one of the most important steps for the improvement of their understanding by pupils and students. Of course, these new strategies should keep a thin equilibrium between historical approach and technical approach, an equilibrium in which the authority argument does not appear too strong, in order to make possible further conceptual innovations based on efficacy reasons. Another sensitive aspect is that of informational selection. What is historically essential and what is technically essential from a wide range of concepts and evolving theories? Very often, the history of a discipline cannot be very well understood from the perspective of the present.
Beyond all these sorts of difficulties, we believe that the benefits of the historical approach of scientific theories make it worthy. The understanding of the dynamics of scientific representations could help pupils and students to become aware about the limits and the possibilities of scientific knowledge. They could understand better the complex interaction among human thinking, scientific reality and physical real. In this context, the science does not seem to have any mythological power. Its representations can be naturally seen as descriptive fictions produced by human consciousness in order to exploit better the capacities of nature. Finally, the scientific values will not be any more mixed carelessly with moral, artistic or religious values. In this way, contemporary human beings will integrate better science among other types of cultural activities, which are vital for the well-being of humankind.

6. REFERENCES

AN APPROACH TO THE PSYCHOLOGICAL DIMENSION OF THE ENGINEER-PROFESSOR

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ABSTRACT: The genuine pattern of the engineer-professor represents a requirement of the modern educational realities. Nobody is born a professor, and by this concept we mean more than the endeavor to attain such an academic title and the permanent preoccupation regarding continuous training and professional advancement, we also refer to the gift (i.e. talent, vocation) that the engineer-professor should possess. A good professor should master didactic competencies which are essential for both the theoretical and practical aspects, and let us remember that the mission of educating future generations is a complex and challenging task, requiring specific competencies and personality traits. Moreover, the psychological dimension of the overall professional background of the engineer-professor, based on pedagogycal relations in the process of professional training, has a special significance.

Keywords: ability, minimum professional standard, continuous learning, skill, competency, benevolent neutrality, psychology, assertive behavior.

1. THEORETICAL BACKGROUND

Aptitudes represent the latent personality potential that enables the engineer-professor to accomplish higher-than-average educational performances. They reflect the quantitative and qualitative measurement, effort and performance level of the engineer-professor involved in educational activities.

Aptitudes cannot be defined as merely particular psychic processes (e.g. perception, memory, thinking or imagination), they are rather an expression of the engineer-professor’s personality as a whole, approached from the performance criterion.

Aptitude expresses the general adaptive potential of the human individual, allowing him to respond to various external stimuli or life-engendered situations as well as to meet any necessities.

Nicolae Mitrofan [4] highlights the following components of pedagogycal aptitude:

- scientific competency (requiring high qualified training)
- psych-pedagogycal competency (provided by the set of skills necessary for „developing student personality“)
- psycho-social competency (represented by the set of skills necessary for the optimization of human interaction).

Competence represents the „knowledge, skills and personal abilities required for the performance of a certain activity, as well as the specific application of these attributes.” Pedagogycal competency expresses „the ability of an individual to accomplish, at a specific level of performance, the set of typical occupational tasks specific to the teaching profession.” This is also called minimum professional standard, i.e. the standard that should be attained by any individual in the performance of main teaching-related tasks, so that the society should be protected against running the risk that this profession might be performed by inadequately qualified individuals. A specific competency requires adaptation, flexibility, changing priorities according to the context.

Ability is „a quality defining the individual who can quickly and accurately perform a certain movement, activity, operation, etc.; it is a characteristic of the individual who is skillful in performing a certain activity; it is a capacity for doing something and an expression of command, craft, expertise, dexterity, endowment, etc.” Abilities and knowledge represent merely potential competences before they are testified by real practice or behavior. They will be highlighted, in a corresponding/appropriate objective interdependence, by a person’s motivations, value and self-esteem. Competences are quite often mistaken for abilities, since they both rely on personal features but the term competence is far more complex than abilities and knowledge, including elements that belong to „core personality”.

Current specialized literature focused on the assignment of efficient communication and, respectively, optimum behavior, recurrently uses the phrase: assertive communication and assertive behavior.

The concept of assertiveness has been introduced by specialists into the field of behavioral therapy, who considered that assertiveness neutralizes anxiety and diminishes depression, „celebrated” as a famous concept in the mid ’70s. Nowadays, this concept is commonly acknowledged as a complex social ability firmly rooted in a social context whereas its acquisition - a demanding task for everyone, even for engineer-professors - contributes to the remedy of interpersonal relationships, improved self-esteem and self-image, positive influence on others, respect as well as an accurate and clear thinking and sharing of ideas.

One of the most successful and comprehensive definitions of assertive behavior, in our opinion, has been formulated by Rimm and Masters [8]: „Assertive behavior is interpersonal behavior involving the honest and relatively straightforward expression of thoughts and feelings that is socially appropriate and in which the feelings and welfare of others are taken into account.” Another definition of assertive behavior is provided by J. Cottraux [2], i.e. „behavior which enables a person to act in his or her own best interest, to stand up for herself of himself, without undue anxiety, to express honest feelings comfortably, or to exercise personal rights without denying the rights of others.”
2. APTITUDES, COMPETENCES AND ABILITIES OF THE ENGINEER-PROFESSOR

The engineer-professor is a successful concept not because of a singular aptitude, but it is rather founded on a set of aptitudes, which permanently balance and intensify each other in view of a higher performance. Aptitudes may be highlighted on the basis of performance. Pantelimon Golu [3] considers that pedagogical aptitude requires several aspects: erudition and specialized knowledge; practical knowledge of individual psychology of students; expertise to disseminate information as well as the knack of affection interaction with an individual or a group of students; cleverness and savvy in a decision-making process; resourceful use of mechanisms able to optimize the educational process.

The conclusions of a survey [1] performed on a number of 690 students, meant to assess professors’ competencies, are hierarchically presented below:

- Thorough knowledge of the subject
- Capacity to trigger student interest
- Enthusiastic aptitudes evinced towards the subject
- Talent of clear explanation

The profession of engineer-professor does not allow mediocrity, on the contrary, it is a noble, complex but attractive profession, all the same, that is not easy to develop. Quite often, experts and well trained specialists in the field of engineering will not be very good mentors, given the lack of pedagogical abilities in disseminating their knowledge and expertise to disciples. This is precisely why genuine professionals in the field have a thorough, undeniable background, but unfortunately, this outstanding training does not suffice in a continuously changing world, in a permanently evolving society, defined by an ever increasing accumulation rhythm. These are the reasons trigger a continuous restructuring of the process of value selection and dissemination from the engineer-professor to the student.

The engineer-professor qualities

![Figure 1. General considerations about engineer-professor qualities](image)

Contemporary society demands that the engineer-professor should be a holder of a sum of qualities, capacities, abilities and competencies required by / sine-qua-non elements of the educational process: pedagogical tact, empathy, communication abilities/discourse quality, intelligence, objectivity/unbiased perspective/balanced attitude towards the students, knowledge of the human soul, specialized competency/outstanding academic qualification/didactic and scientific authority, pedagogical resourcefulness for interdisciplinary connections, stamina, commitment to the profession, creative thinking/ingenuity, genuine moral profile, ability to elicit student cooperation and participation, as well as the to trigger and maintain student interest and desire for learning, to encourage student freedom, to become a non-coercive mentor and set a good example, to be conversant with psychology and pedagogy, and have a thorough knowledge of the world and life, and, last but not least, to be a polite person. Furthermore, the engineer-professor should be a dynamic and constructive individual, aiming at and able of introspection, to identify weaknesses (flaws, standstill, regress) as well as strengths (progress, evolution, accumulation), to evince psychological openness to interpretation and re-interpretation of human interaction, associated with a sense of humour and emotional intelligence.

<table>
<thead>
<tr>
<th>No.</th>
<th>Engineer-professor qualities</th>
<th>Q Type</th>
<th>Answer ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>the art of educating pedagogical tact</td>
<td>CA</td>
<td>82</td>
</tr>
<tr>
<td>2.</td>
<td>outstanding academic qualification/ didactic and scientific authority/ specialized competency</td>
<td>CA</td>
<td>81</td>
</tr>
<tr>
<td>3.</td>
<td>objective/unbiased perspective balanced attitude towards the students</td>
<td>CA</td>
<td>74</td>
</tr>
<tr>
<td>4.</td>
<td>intelligence</td>
<td>CA</td>
<td>67</td>
</tr>
<tr>
<td>5.</td>
<td>morality/genuine moral profile/honesty</td>
<td>A, CA</td>
<td>62</td>
</tr>
<tr>
<td>6.</td>
<td>to have a sense of humor and emotional intelligence</td>
<td>A, CA</td>
<td>60</td>
</tr>
<tr>
<td>7.</td>
<td>ability to be a polite person</td>
<td>A, CA</td>
<td>59</td>
</tr>
<tr>
<td>8.</td>
<td>communication abilities and discourse quality</td>
<td>A, CA, CO</td>
<td>47</td>
</tr>
<tr>
<td>9.</td>
<td>empathy</td>
<td>A, CA, CO</td>
<td>39</td>
</tr>
<tr>
<td>10.</td>
<td>commitment to the profession</td>
<td>CA</td>
<td>39</td>
</tr>
<tr>
<td>11.</td>
<td>ability to elicit student cooperation and participation to trigger and maintain student interest and desire for learning</td>
<td>A, CO, CA</td>
<td>39</td>
</tr>
<tr>
<td>12.</td>
<td>ability to become a non-coercive mentor and set a good example</td>
<td>A, CO, CA</td>
<td>33</td>
</tr>
<tr>
<td>13.</td>
<td>a dynamic and constructive individual</td>
<td>CA</td>
<td>31</td>
</tr>
<tr>
<td>14.</td>
<td>stamina</td>
<td>CA</td>
<td>30</td>
</tr>
<tr>
<td>15.</td>
<td>pedagogical resourcefulness for interdisciplinary connections</td>
<td>CA</td>
<td>29</td>
</tr>
<tr>
<td>16.</td>
<td>creativity/creative thinking/ingenuity</td>
<td>CA</td>
<td>21</td>
</tr>
<tr>
<td>17.</td>
<td>knowledge of the human soul</td>
<td>CA, CO</td>
<td>21</td>
</tr>
<tr>
<td>18.</td>
<td>ability to encourage student freedom</td>
<td>A, CO</td>
<td>15</td>
</tr>
<tr>
<td>19.</td>
<td>aiming at and able of introspection, to identify weaknesses as well as strengths</td>
<td>A, CO, CA</td>
<td>11</td>
</tr>
<tr>
<td>20.</td>
<td>ability to be conversant with psychology and pedagogy and have a thorough knowledge of the world and life</td>
<td>A, CO</td>
<td>7</td>
</tr>
</tbody>
</table>

Our prototype for the engineer-professor is a sum total of all the above-mentioned characteristics which define various levels of teaching and shape pedagogical competencies and professional performances, as well as provide additional value to the student who is thus urged to stimulate thinking, to assimilate fundamental specialized terms and especially to develop appealing expression abilities upon graduation.
The personality of the engineer-professor should leave its imprint on the make-up of the student on the process of becoming a graduate engineer. The authors of the present paper consider that the engineer-professor should evince a benevolent neutrality, a term borrowed from Freud’s psychoanalytical theory – meaning a highly empathetic attitude towards all that is human in us, both the engineer-professor and the engineering student. This expression does not leave out warmth, communication, empathy and affection towards students is deep and genuine. Students are more eager and willing to study when the professor is more understanding and can get close to them.

The engineer-professor should be the heart and soul of the department/faculty/university to which he belongs, thus holding a prominent role and continuously contributing to re-establishing the statute and fame of the teaching staff. He develops, educates (breeds, feeds, grows) himself and to each new generation of students. The pattern of the engineer-professor is taken over by the Faculty of Engineering, the University and further by the society where the formerly trained students are integrated. Therefore, the engineer-professor and the University at large have two main functions: to produce professional competencies and culture. Thus education has its own role in and for society.

All the feelings and actions of the engineer-professor are in agreement with his personal image of himself. This image is very important, since it can become a friend or an enemy, according to the manner of „feeding” ... should it be fed on failure then it undermines the present, should it be fed on success then it encourages and leads to progress – the essence of living with one’s own self. The significance of one’s own image, and the agreement between self image and social image is one of the positive factors for the adjustment to professional and social requirements [7].

It is essential for the engineer-professor to become aware of the significant function undertaken in society – i.e. upgrading the cultural level of the engineering graduates – and therefore should be more self-reliant. He should find out the secret of harmonious living with one’s own self, he should have a realistic perception of himself and grant due respect. Self-acceptance is an ability that renders trust, whereas the attempt to behave unnaturally leads to a state of permanent tension.

The engineer-professor will take over a multitude of roles, both in the faculty and in society, therefore he should become aware that performing these roles depends on the shaped personality, professional culture, attitudinal and aptitudinal qualities.

The fundamental principle of the existence of the engineer-professor resides in the continuous and permanent transformation for the better of both oneself and society, in other words assertion and accomplishment of a beneficial optimum. Should we give up on educating ourselves as professors, then we have no moral right to teach others. There is nothing that can make us think that we hold absolute truths. The ability to teach future engineers how to find by themselves what they need to know is an art, a never-ending „work-in-progress”, and one’s own example cannot be denied.

The learning process should be life-long and on-going and it should also represent a priority for higher education quality assurance and even the only opportunity for the development of Romanian higher education, since outdated, archaic practices need to be replaced by modern and updated teaching techniques. This is precisely why higher education quality relies especially on the degree of professionalization of engineer-professors in spite of experience having testified that the „model” is still the most efficient and efficacious means of learning or training the individual. The young will always imitate certain models, therefore professors and parents stand for two fundamental models in the training and evolution of the future specialist and citizen, constructive for himself as well as the society he belongs to and lives in.

There is no universally valid solution as regards teaching methods and techniques that might be applied to engineer-professors, engineering students or other academic subjects. The engineer-professor and students cannot understand each other, it is all just a happening of life, where both „parties” have to meet each other halfway.

Therefore, the authors of the present paper firmly believe and support William Arthur Ward’s idea that: “The mediocre teacher tells. The good teacher explains. The superior teacher demonstrates. The great teacher inspires.”

3. PARTICULARITIES OF ASSERTIVE BEHAVIOR OF THE ENGINEER-PROFESSOR IN THE ACADEMIC STRUCTURES

Faculty communication within academic units (i.e. department, faculty, etc.) requires permanent interaction between the engineer-professor and student, as well as the engineer-professor and professor. We have already analysed the teaching relation between the engineer-professor and student, however we consider it necessary to set forth several remarks regarding the relationship between engineer-professors and their colleagues at the Department/Faculty of Engineering.

We can definitely and undoubtedly state that this psychological component of the engineer-professor is encountered in the interaction among colleagues, and our study focuses on the particularities of assertive behavior in the department or faculty.

In order to support this opinion we can state that the lack of assertiveness represents one of the most significant sources of social inadequacy, as a result of a set of acquired attitudes and behaviors with long-term consequences for the improvement of social relations, trust development, respecting individual rights, developing a healthy lifestyle, improvement of responsible decision-making abilities [5].

We have already discussed that assertiveness can be acquired, as it is not an inherited personality trait nor does it occur in an interpersonal context. At the same time, it is an expressive ability, made up of verbal and non-verbal components. Assertiveness as a type of behavior is subject to several criteria, such as: effect, technical, cost/benefit, and cultural [6].

The employment of assertive behavior in the interaction with the colleagues at the department/faculty of engineering (often confronted with miscommunication, team work problems or peer competition) may lead to powerful relations and minimal negative emotions, self-actualization, ability to communicate, to share one’s feelings, experiences, ability to make decisions, to defend the positive values and availability of expressing one’s thoughts, beliefs and feelings constructively.

Our opinion is that assertive behavior is the only solution to all the problems occurring in the relationships among engineer-professors, since the cognitive aptitudes of each individual engineer-professor, hold a significant place and become relevant for assertive actions. This is precisely why
assertiveness yields positive results in the shaping, developing and strengthening relationships among engineer-professor and they stand for respect, well meaning, well intentions, positive trend and constructive dialogue and its characteristics are as follows:

- Speech fluency and eloquence
- Average voice tonality, usually higher than the in everyday conversation
- Average level of intonation
- High degree of firmness, without eliciting defence responses from the other participants to conversation
- An attitude of no expectations, without pressing for desired answers, and allowing for personal opinion
- Clearly-expressed opinions
- Respecting other opinions and perspectives, expressed directly or indirectly by participants, that might contradict our own
- High degree of accuracy in discriminating among various situational responses
- Integrating more information, thus increasing the degree of conflict-related tolerance
- Providing a higher degree of amplitude to the usage of personal standards, though rational to problem solving

Individuals evincing assertive behavior are able to send more positive information about themselves rather than negative ones, whereas non-assertive individuals send a relatively equal number of positive and negative self-referential statements. Engineer-professor can efficiently learn and teach as long as they develop abilities, qualities, characteristics such as: flexibility, empathy, self-reliance and self-esteem, maturity and emotional balance in their interaction.

Engineer-professors should be aware that assertiveness requires the strategy of confronting the problems not the participants to discussion. Thus you will express and assume your opinion, make clear statements on the issues that need to be changed of desired answers, and allowing for personal opinion. Consequently, expectations will be met, leading to that balance, communication channel that allows identification of new possibilities of approaching problems and, at long last, to identify the best solutions.

Even conflict may represent an initial stage in problem solving, improving communication, developing trust in oneself and others (as well as their trust in us) provided that attitude and approach are appropriate. Conflict should be considered as a natural method of the process of communication. The engineer-professor should remember that, first and foremost, we are all human beings (professors, students, auxiliary teaching staff), however, we are different, unique, with positive and negative aspects, as well as common denominators: expectations, hopes, psychological needs (the need to be loved, accepted, respected, the need for social recognition), flaws, fears, ideals, qualities, feelings, etc. – that is we aim for that wellness that some people call happiness. We should never forget to distinguish between individuals and problems. We need to respect human beings when confronting problems as this is the only way of finding balance and solutions by means of urging everyone’s participation to solution identification. There is always a method to meet people half way in order to satisfy expectations.

It would be far from real to state that assertive individuals are always able to solve problems or that they hold a universally valid remedy, however, these persons should undoubtedly exist or express since they possess the ability to manifest firmly, clearly, they are powerful, they master their own instinct or drives, unlike other individuals who choose to impose their opinion by hurting other’s feelings. Humiliating or offending others will not lead to success or a positive result, since this attitude does not attract respect or fame, or make one popular. Lack of respect, improper vocabulary, uncivilized tone, lack of listening abilities, etc. are easy to evince but they are no guarantee to problem solving, on the contrary, we only manage to depart from the initial goal, topic or expectations.

Nowadays, when the economic crisis can be felt ever more acute in all walks of life and all over the world, engineer-professors are defined by material values immediate, pragmatic results. They should be aware that a balanced approach, the individual ability and decision, mutual respect should prevail and these are all to be found in ourselves. These needs will only be satisfied when we feel able, when we evince self-reliance, when we are responsible, when we have feelings of belonging to a group (department/faculty), when we respect and give up the erroneous idea that we possess absolute truths.

4. CONCLUSIONS

Training to become an engineer-professor is a challenging and time-consuming task and it includes a scientific dimension and a significant practical component, both of them sine-qua-non elements of any valuable teaching mission. At present, a great number of young people are eager to grow as fast as possible, sometimes even dismissing certain stages that are essential to their training as future engineer-professors, since this profession also involves responsibilities in training future generations as well. The goal is to attain the title of engineer-professor, but this means a new beginning where continuous improvement, professional evolution, perpetual transformation of the individual due to the uninterrupted access to latest information at the national, European or international level, they all represent fundamental and indispensable elements of professional satisfaction. A genuine engineer-professor is able to educate as long as he is concerned about his own education and training. In order to support this theory let us mention the Romanian philosopher Constantin Noica with the statement „a school where the teacher doesn’t study is but an absurd concept“.

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THE MANAGEMENT OF TRANSLATION IN MODERN ORGANIZATIONS

Marilena, Milcu
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ABSTRACT: There is no doubt that business trips are very beneficial for all international and national organizations. This is mainly why the international communication has changed into one of the most significant elements for the development of a good number of enterprises. But if people come and go without any problem all over the world, it is definitely not the same thing for written documentation. To be more precise, this documentation circulates but, without any adapted means of transportation, one has to admit that the information is finally transmitted in a very difficult way. Information gets to his recipient in excellent conditions through marvelous tools such the fax or the Internet. But too often than expected, after the information arrives, it is not completely understood because of the translation problems, which are very important. This is why the translation activity became more and more imperative for the modern organization and we can speak nowadays about the management of translation in modern organizations, because the process of translation must have its specific rules, principles and strategies.

Key words: differences of opinion, conflicts, experiment, conflict management.

1. INTRODUCTION

Translators do not usually hold a position in the organizational structure of a company that will allow them to talk as equals to their clients within the respective company. The client is actually the employer. When it comes to the translator’s place in the organizational structure of a company, a distinction ought to be made between the role translation departments should have within the company and the role they actually play, not to mention their role in enhancing the company’s prestige and reputation with the public and with its partners. The translation department should be granted certain autonomy and a status within the company that would provide direct contact with senior management. In order for a translation department to be able to properly perform its functions, it needs to be aware of the views and principles of management, in order to translate correctly. But we know that this is not the way things happen. The translation services of a company are usually provided by other departments, usually the advertising or communication department or even the administrative department or even to the administrative department. This can often cause delays in the work, due to the fact that the channels between the client and the translators are too long. Texts that others have taken three weeks to write cannot be translated in a mere half an hour. That is why translation departments should have their autonomy and their own budget.

2. INTERPRETER’S AND TRANSLATOR’S ROLES

Before addressing the issue of translation within a company, it is perhaps important to locate the translator in the context of language services. The translator is seen as a man (or woman)-orchestra, responsible for solving all the “language problems” within the company. However, the translator is not, strictly speaking, the sole provider of language services. In the field of language services, the various professionals are of several types and they serve various functions: The translator’s role is to translate, orally or in writing, any text or document in a written or legible form (the document may also be electronic). According to the degree of specialization of translated texts or the nature of specialization, one can distinguish between: general translators, specialized translators, translators of technical texts, translators of legal documents, translators of commercial texts and literary translators. According to the context within which translators carry out their work, we can distinguish between: publishing house translators, business translators, agency translators, company translators, translation office translators and freelance translators. The names tend to be further clarified in order to narrow delimitation of areas of expertise of translators. There are more and more frequently „translators of software” or specialists in very limited specialty area. It goes without saying that these names do not correspond in any way to all occupational categories and that they are in fact similar to commercial brands.

Then there is the interpreter, whose role is to translate oral materials in an oral manner (speeches, lectures, presentations, etc.). According to the context of performance, one can distinguish between: conference interpreters who translate instantly presentations made by participants in international conferences, consecutive interpreters, who translate words of the speaker only after the latter pauses, and 'liaison' interpreters, who translate less structured conversations or exchanges, particularly in the field. The terminologist identifies processes, defines and manages specialized terms or „specialized vocabulary”. Most often, terminologists put together databases of terms or electronic dictionaries. Their job is to find words, clarify definitions, suggest equivalent terms, organize vocabularies. The editor is responsible for producing documents without going through texts already written in another language. The researcher is responsible for seeking information and organizing it but also for establishing and organizing documents. If we have reviewed the various providers of language services is simply to clarify the nature of the functions of each of them. In practice, two approaches are emerging, according to the specialization of services (if the volume of translation services is considerable – within large-size companies – the translation services and their providers bear one of the following names: translator, conference interpreter, terminologist) and versatility (when the volume of services does not justify the narrow definition of the functions or is not sufficient to guarantee adequate supply, versatility is required under the generic label of translator, or the names reflect the variety of tasks (translator, interpreter, translator-editor, terminologist, etc.).
3. CATEGORIES OF TRANSLATORS AND INTERPRETERS

In the world of translation, no typical structure emerges and we can simply identify broad categories covering diverse situations. One can traditionally distinguish between:

- Isolated freelance translators, including expert translators
- Freelance translators
- Translators providing services or working within
- Translation „offices”
- „Pirate” translators
- In-house translation services
- Translators may be simultaneously or consecutively, in several categories. But we’ll mention here of the following: independent freelance translators, in-house translation offices, birth and evolution of in-house translation services, the translator “detached” from any company

3.1. INDEPENDENT FREELANCE TRANSLATORS

Independent freelance translators perform, in their working languages, translations commissioned by companies. They devote a large amount of time to canvassing and to administrative activities (accounts, billing, telephone canvassing, accounting, money cashing, etc). They look forward to the day when two or three „major customers” will prove sufficient to ensure a flow of cash and will, perhaps even in return for a fee, allow them to sub-contract some translations to other freelance translators and set up a type of translation „agency” or „office”. In anticipation of this blessed day, independence is not without negative counterparts. Until they manage to establish a reputation on the market and to create a list of faithful customer expected to develop by word of mouth or through recommendations, their canvassing will be quite unproductive. Depending exclusively upon his own competences, the independent freelance translator cannot cope with the diversity of specializations or languages required on the market, especially at the degree of excellence required (since important translations, such as translations of highly specialized texts are commissioned to agencies or translation offices with enough labor force and skills to allow them to take on not only large volumes of texts, but also technical). Constrained by the need to earn a minimum income, the translator must accept translations covering a wide range of subjects, usually with very little time for research: everything in blunt disproportion to the fee he can actually claim. It is not uncommon that a freelance translator be forced to sacrifice his ideals of quality to the reality of the wallet-bearer. The independent freelance translator cannot handle by himself the contracts that are most lucrative because of their volume (contracts involving thousands of pages) and that require proportionately less research of a variety of fields than small disparate contracts.

3.2. IN-HOUSE TRANSLATION OFFICES

In-house translation offices perform translations to the exclusive benefit of the organizations (businesses, companies, departments, etc.) within which they were set up. When the workload exceeds the capacity of the in-house office, the latter makes use of subcontractors, by outsourcing. The main difference between in-house translation offices and subcontracted translation offices lies in their relationship with the commissioner of the translation. Requests to an in-house translation office come from within the same “house”. The relationship between in-house translation offices and commissioners within the same company are complex, either because the in-house translation office is often regarded as a mere service-provider, perfectly repayable by a simple „thank you”, or because the authors of the technical texts to be translated hold an unshakable opinion of their „linguist co-workers”. It is not uncommon for the in-house translation office to be placed in the impossibility to come up with a schedule for their work, mainly because the requests come too late on account of there being a specialized office available that can theoretically take over at any time any volume of translation. The translators working with the in-house translation office are often placed in an uncomfortable situation. It is their duty to raise awareness of the services they provide, and then convince their “in-house” partners (commissioners) of their ability to process technical data and translate them satisfactorily. Translators must also demonstrate that quality translation is not mere improvisation and that the quality of a translation is always in direct correlation with the quantity and quality of „contributions” by the commissioners, especially when geographical proximity and membership in the same professional background are guaranteed.

3.3. BIRTH AND EVOLUTION OF IN-HOUSE TRANSLATION SERVICES

In-house translation offices were created starting from an initiative: I „researcher” or „assistant translator” or „translator” who, based on the finding that something was missing, have established or reinforced an embryo of in-house translation that can make aware all interested (commissioning individuals or services and / or users of translations, administrative services, financial services, etc) of the utility and profitability of adequate translations. By power of example, the office can grow and start to diversify. Then comes the stage of awareness of the need to come up with a coherent language policy. This awareness is often triggered by problems of terminology (neologisms, standardization, consistency of terminology translation and writing) but fast on the outside of what is conventionally called a language policy, especially when it includes important scientific, technical, or economic requirements. The definition and implementation of a language policy (often linked to the purpose of quality control of translations and of the texts produced by the organization in question) generally lead to the idea of discussing names and designations and creating in a sense, a language catalogue of the company, business, government agency, non-governmental agency, research center, plant, laboratory, etc.). They also lead to a reflection on the techniques of management and exploitation of terminological data identified, analyzed, or generated. At this stage, the in-house translation office becomes a provider of „linguistic services” which comes very quickly to understand and to make understood the need for an effective communication policy. The third (and, for now, last) stage of the evolution of in-house translation offices redefines the functions and responsibilities of translators who take it upon themselves (or want to take it upon themselves) to create, organize, and manage communication in the most natural way possible.

The in-house translation service turns into an in-house communication service, wherein translation, in the traditional sense, is an activity that comes to complement terminology (the study of specialized vocabularies), terminography (the production and identification of specialized vocabularies), the management of specific vocabularies (computerized management), editing, linguistic counselling, and perhaps the development of language tools (translation aids, writing aids, etc.) Developments towards the integration of language services are also the short-term objective of many independent
offices. It is however hampered by the fact that companies tend to specialize their employees.

3.4. THE TRANSLATOR „DETACHED” FROM ANY COMPANY

The “detached” translator, also called „delegated” translator, or translator „on a mission”, is a particular case of subcontracting by a translation office, whereby a translator or a team of employees of a translation office visits a company in order to address, at request and in-house, one or several contracts for translation. The formula has the advantage of allowing the company to have a translator assigned without having to be the employer. This formula was thought of in situations requiring respect for confidentiality and has developed within companies with a view to strengthening cooperation between translators and company staff or to ensuring a closer control of the task performance. It found its natural application in companies that want or require translations to be carried out on equipment or software that, if acquired by the translation office, would be extremely costly. This formula is becoming increasingly popular, as companies realize the benefits they have by sharing one or more translators. It applies more to missions abroad as a realistic option for multinational translation. The scenario developed above gives a fairly accurate representation of the diversity of possible situations. In order to get an exact image of the translation, it remains to clarify the scale of numbers, the volumes of translation, the quality levels, and turnover by type and implementation unit. Such an undertaking would require time and might give a false image to the extent that it could take into account the volume of activity of “pirate” translators, who are very numerous.

4. CONCLUSIONS

- More often than not, we only translate reluctantly and at the last moment.

In the process of dissemination of a document, the marked steps are typing, layout, reproduction, publishing and shipping. It rarely happens that translation be taken into account as a piece of this chain to the extent that, when the need arises, companies are almost always forced to resort to emergency solutions. The same thing obviously happens in the process of receiving a document - letter, invitation to tender or article in a foreign language. Given that no translation is provided, one has to “make do”, to try to understand, even to consider ambiguity or misinterpretation as part of either profits or losses.

- You need to have it translated by anyone

Given that each of us, during our studies, has tried translating, it seems common sense that anyone with a mastery of a foreign language should be able to translate. Thus we often entrust this responsibility to an engineer or even a secretary (improperly) considered „bilingual”. Taking risks without even knowing it, we do not hesitate to ask them to translate „in theme”, that is in a language they are familiar with but which they obviously do not have the use of. Tasks that even a professional translator would be reluctant to perform - and often refuses to – are therefore unconsciously given to newcomers in the field of translation. Who hasn’t read the manuals, „made in Japan” or “made in Hong Kong” that are simply incomprehensible in French? Another relevant example is the use of a „translation agency”. It is a natural reflex to hire a subcontractor specialized in a field of activity other than that of the company in question. But in this case, the bad surpasses the good without the purchasing department of the company being able to see it. Without being informed about the technical constraints of translation, no precautions can be taken on the mastery of a specialized vocabulary or a particular context. If the text to be translated is rich, we will not hesitate - it is obvious even for the translation of „memoirs” or novels - to divide it into chapters that could be given to translators without contact with each other! One can imagine the result in terms of the unity of style.

- The cost of translation is underestimated

This is the obvious corollary of our first two findings: the verb „mesestimer” is to be taken here in the strict sense: it can also mean we underestimate the reverse. The translation has a reputation of being expensive, too expensive, no wonder most often what was the cost borne by the company for the first draft of the report that is translated, and all costs that have accompanied by documentation, typing, reproduction, and others. It would be that the translation is only a relatively modest sums invested. But on the other hand, we do not know the amount of work, research, necessary for a good translation. Perhaps, indeed, is that denigrate the value of work being conducted in this field, hopes that one based on „translation” they are based in part on the idea that the translation would, in essence, a mechanical operation of a machine programmed to perform better, faster and cheaper than humans.

- „Educating” the customers

Unfortunately, without doubt, that the translators did not have, so far, the means or the courage to better „educate” their customers. It must be said in their defence that their market is so vast that they can afford to reject the impossible or, simply, weird. But the question is not to defend the quality of life of a professional if it is honourable. It is the quality of service businesses, and will, more and more necessary. And to get that capacity, donors should work to recognize that translation is a profession, with all that this involves training, specialization, trust among partners who everybody knows what it needs and what it is his duty to request another.

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GENDER IN ENTREPRENEURSHIP: PROJECT “P ∞ – SUCCESS IS FEMALE!”
(PROGRAMME “POWER FOR WOMEN ENTREPRENEURS”) 
AT WISMAR UNIVERSITY

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ABSTRACT: According to the International Study on Entrepreneurial Activity – “GEM” Annual Report 2007, a gender difference in business exists throughout all regions. The gender distribution shows similar patterns in middle- and low-income countries as in high-income countries, although females are less underrepresented among entrepreneurs in middle- and low-income countries as in high-income countries.¹ Still 73% of innovation-driven countries had significantly higher levels of training among men than women. Though, women are also successful in setting up companies². These facts indicate some clear differences in factors, which affect the attitudes and motivations of women – and therefore clear implications for the type of support, which women need to get started.

1. INTRODUCTION

Entrepreneurship is essential for the growth of an economy and female entrepreneurship has a significant role to play to increase the growth of business start-ups.

Women are often more successful in setting up companies than men. They are less likely to fail on the road to self-employment than their male counterparts. However, women usually have less financial means, are often rated more critically by banks, and are frequently under greater pressure as a result of their role within the family. That’s why the number of women setting up companies is considerably lower than that of men.

Whereas currently approximately 12% of all gainfully employed men become self-employed, the rate for women is only half of that. Only one of four companies is founded by a woman. The share of women in technology-based company start-ups, particularly spin-offs from research institutions and institutions of higher education, is even lower, between 10% and 15%.³

The programme “Power for Women Entrepreneurs” focuses on the following key areas: analysis of the structures and potential for women to set up in business as well as exemplary and innovative measures for mobilizing the entrepreneurial potential of women in order to support women setting up in business. The Project “P ∞ – success is female!” is funded within this framework.

2. PROJECT DESCRIPTION

To awaken the spirit of entrepreneurship by female students, graduates and staff, Wismar University is participating in the Project “P ∞ – success is female!”, which focuses on potential women-owned businesses: motivate women to start and grow their own businesses. The project is intended to give the female students new perspectives, supporting and accompanying them on their way towards self-employment.

To reach this as special framework is being created, which contains positive identification offers for potential founders; i.e. it enhances involvement in entrepreneurial commitment and wakes interests for professional independence.

Future student generations and especially female students should be encouraged and supported with appropriate environment to turn their technological innovations and research results into products and their successful establishment within the market.

Considerably fewer women than men have dared to take a step to their self-employment in technology-oriented foundations of businesses. The project’s goal is to sensitize and to motivate female students, graduates and staff for the entrepreneurship on the one hand, and to advice and support of the interested potentials in founding a company on the other hand.

Moreover, the best-practice-models will be developed, in order to improve the entrepreneurial potential of women in high-tech sector nationwide.

To achieve the goals the project has therefore four components:

Component 1: Sensitization and shift in attitude

In entrepreneurial environment mainly male entrepreneurs and their successes are presented. The successful female-entrepreneur shall be better represented, so that also female-students, graduates and staff take a notice of self employment as an alternative to the employee relationship. Female patron of the Project “P ∞ – success is female!” and of the other project partner universities and other successful businesswomen appear as role model in panel discussions, posters, advertising and exhibitions.

Component 2: Discover and awake the start-up potential

An extensive range of online services comprise detailed information about setting-up businesses, profile test and business simulation game. Profile test will be used to estimate women’s potential for business skills. The business and common skills, as well as gender-specific aspects will be considered in the business simulation game.

Participants get recommendations how to improve their business competences after analyzing their strengths and weaknesses. They will get support in start and grow their own businesses – in workshops and individual consultations. In addition, it is possible to exchange with young entrepreneurs and individuals interested in founding a company within the network “national agency for women start-ups” (bga). Project
participants have also a possibility to complete internship in women-owned companies.

Component 3: scientific monitoring

Renowned scientific partner check the project measures and identify best-practice-modules which will be transferred to other project partners. The measures will be analysed by qualitative method: participating observation, qualitative interviews with university representatives and entrepreneurs, standard surveys and group discussions. Quantitative surveys will be used for collecting data about entrepreneurial affinity by new female students as well as for indicators identification for the friendlier organizational university structure.

Component 4: Transfer to partner universities

Measures, jointly developed by Technical University Berlin and University Stuttgart, will be transferred to other project partners. The project partners deliver their input to selected project components and feedback to realization in their milieu.

3. APPROACH AND RESOLUTION

Wismar University as project partner contributes to target group motivation and improvement of the conditions for self-employment as well as self-definition and self-respect.

In particular, Wismar University encourages female students, graduates and its staff to the motivation and ability to set up in business. The following activities are running: profiling test and, as a result, additional qualification modules whose development was based on the test results; assistance by development and testing of additional modules concerning gender-specific issues of the business simulation game and further development of the university’s activities in view of the gender-specific issues.

Regarding activities of the sensitization and support of the attitude change the results of Technical University Berlin, i.e. drafts and instruments of the Public Relation campaign will be transferred, tested, converted and adapted at Wismar University, with the conditions of a smaller East German university in an for Germany economically underdeveloped region. The women-owned enterprises from university environment will be selected to provide a necessary internship. These entrepreneurs will be closer introduced and questioned to their experiences in panel discussions.

Furthermore, from the Technical University Berlin developed online profile test will be offered to and applied by the female students, graduates and staff of Wismar University. Thereby women will be encouraged to take an approach to the start-up issue, to learn their strengths and to rate and work on their weaknesses.

The co-operation by testing from the partners developed gender specific modules for business simulation games will be transferred, tested and rated as a possible part of the business simulation game of the Wismar University – the LUDUS program.

A special offer in the project will be additional education modules, which are conducted from needs of the profiling tests results, especially through competence tests and diagnostics of potential technology oriented foundations, diagnostics of the inhibitions in terms of study orientation and self-employment willingness in various study disciplines.

On this basis further education modules will be offered to motivate students to start their own business. At the same time apart from the prime study their attention will be also attracted to special methods and social competences that are crucial for the successful establishment of knowledge-based enterprises. Therefore, competence trainings in optional module combination will be offered.

Moreover, already established entrepreneurship services of Wismar University will be reviewed and modified respecting gender-specific aspects. The goal is to expand the “Entrepreneurship Duel” - a project where an entrepreneurial multi-disciplinary team “turn an outside idea into the own”.

The first Entrepreneurship Duel started in March 2004. The starting point was to reduce the fear to failure by student business start-ups. For successful business start-ups the following conditions should be fulfilled: business idea, market and realization concept as well as a good student’s team with professional and soft skills. The following questions were posed:

- The source of business ideas is often in the already existing companies: doing their business they open up new possibilities for the new products and services but the lack of resources (time, personal, financial) does not allow its realization.
- Some companies would like to be involved by the realization of their business idea.
- How to make foreign business idea to the own one?
- The female students usually could not imagine themselves in the role as business women.

Based on the starting point an Entrepreneurship Duel was developed.

The Entrepreneurship Duel is a competition of two teams. There are 3 participants from different faculties in each team. By the interdisciplinary teams it is possible to cover all important business areas, the technical as well as the economic components. The ideas of the respective Entrepreneurship Duel must be comparable with each other for the evaluation of the results for defining a winner's team at the end of the competition. The students and graduates can apply for participation in Entrepreneurship Duel. They have a written and an oral exam. After the setting up of the teams and receipt of the business idea every team get an fully equipped office in Technology and Science Park in Wismar for six months – duration time of the Entrepreneurship Duel. In this time they make idea ready for the market and they working on marketing strategy as well as they improve their soft skills. The teams get support from the idea-giving companies, from the supervising professors and from the Centre for Entrepreneurship at the University. After finishing the Entrepreneurship Duel the teams are able to set up their company and continue their business activities.

This education module will be modified step by step for female students and tested, because they are underrepresented in this competition - in the past and in the present time.

The adaptation within the framework of the project will be done in three steps:

Step 1:

The experience of the last years shows, that only few female students apply for participation in the Entrepreneurship Duel. The reasons therefore were not evident. The female students have been questioned for the possible reasons preventing them from the participation.
The following restraints have been named:

- missing the right business idea,
- fear to take responsibility for the team,
- lack of self-confidence,
- absence of knowledge about formality processes by business start-up and
- high business risk.

Step 2:
Based on the first step, detected inhibition threshold by female students will be analysed and used for development of additional qualification modules for the competence training.

Step 3:
The Entrepreneurship Duel will be realised by female students. The participants will be supported especially in gender-specific areas of business processes and soft skills. After the competition the students will be interviewed and the results will be taken into account by improvement of the qualification modules as well as for the transfer to other project partners.

Finally, it can be stated that measures, jointly developed by Technical University Berlin and University Stuttgart, will be tested for their possible and efficient implementation at Wismar University in its role as a smaller East-German university. Modification of the measures is possible if required.

Furthermore, Wismar University transfers project results, e.g. competency diagnostics, analysis of the inhibition threshold and advanced female Entrepreneurship Duel to project partners.

The project will be implemented by University Stuttgart and Wismar University of Applied Science; Technology, Business and Design, and coordinated by Technical University Berlin. The project is financed by the European Union (ESF) and the Federal Ministry of Education and Research and it is free of charge for the participants.

4. REFERENCES
MANAGEMENT OF ENGINEERING AND BUSINESS INSTITUTIONS
MARKET SEGMENTATION – DETERMINING FACTOR OF THE COMPANY’S CREATIVITY

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ABSTRACT: The market segmentation can have a crucial importance for the way the successful companies run their businesses. It is relatively easy to conceive theoretical ways of classifying the clients, which can be very attractive from an esthetic point of view, but it is more difficult to make them work. For the segmentation and the different treatment of the clients, the entire company must know the marketing management process and must make the necessary adjustments in areas like: client service, acquisition or new product development. From this perspective, the market segmentation becomes a structural problem for the company, problem that belongs to the marketing strategic thinking level. This paper aims to demonstrate that the market segmentation is worth the effort and the risk which a company takes, fact that imposes an organizational change. The new database and Internet based technologies give the companies better usage capabilities of understanding the client, understanding obtained by using an effective market segmentation.

1. INTRODUCTION

Produce and sell has been for a long time a paradigm that dominated the business world. The companies that are based on this principle estimate the market request, the production planning and create trade stocks in order to ensure a balance between the offer and the demand. They follow, firstly, the creation of economy of scale, to shorten the duration for the assimilation by the employees of some new attitudes and to apply well defined procedures in accordance to a pre-established business plan. Presently, many companies act accordingly to the principle understand and respond. These companies invite the clients to define their general needs and event to choose the exact attributes of the products that they want. The companies develop certain activities as a response to the orders received and they use the digital technology to rapidly fulfill them. For the companies that use the principle of understand and answer, the rigorous market segmentation has become a mandatory demarche.

Right now, the segmentation of the clients is no longer a simple marketing technique or a statistical one. It can have a crucial importance for the way the successful companies run their businesses. The Internet allows the company to inform the companies about what he likes, what he doesn’t like and what his general characteristics are. The information can be used by the company to create a client segmentation realizing thus fore an inverted segmentation. [1]

2. MARKET SEGMENTATION

The market segmentation has become an important strategic planning tool [2]. Unfortunately very few marketing managers have understood that the segmentation is a strategic measure. In order to create an effective segmentation, the approach must be an integrated one with all the marketing efforts. With other words, the segmentation presumes the identification of the: business in which the company operates; benefits that it wants to offer and the definition of agreement by which these benefits for the clients could be modified.

The process of market segmentation was imposed in the science of marketing by Wendell Smith in 1956. This process has known permanent improvement at the level of the tools and techniques used at the client data segmentation.

Without a strong database technology, the majority of the companies have initially used a client segmentation based on series, according to the needs identified by the marketing research. The vast nature of the series based segmentation and the delays connected to the information analysis offered by the marketing research, have caused losses for the client because of the wrong offer. The series based segmentation has proven difficult to manage by many companies. At the same time, the clients’ expectations, on one hand by the service differentiation and on the other hand the product differentiation, are always increasing. There fore, the relevance of the client is much more challenging then the series based segmentation. [3].

Next it followed the demographical segmentation, whose techniques were attentively studied [4]. In the case of the demographical segmentation, it has been proven that the analytical efficiency is one thing, and the commercial practice is a completely different one. Concretely, it is difficult to identify the demographical differences between the persons that prefer distinct brands from the same category (for example, the users of Visa and MasterCard, the drivers of Mercedes and BMW).

The ones that have practiced this type of segmentation have easily become aware of the tendency of restricting the segmentation based on a demographical analysis if the differences between the segments are not obvious. The conclusions drawn from this was a natural one: the demographical segmentation is not very effective in marketing terms.

The limits of the two types of segmentation have determined Piercy (1998) to make a useful analysis with regard to the important connection between segmentation and strategy on one hand, and the segmentation and capacity on the other hand. The both dimensions must function. The previous two segmentations have proven to be useless if they are not compatible with the internal competences of the company.
The segmentation must have as starting point the definition of the company, of the markets which this one wants to compete on and of the key components at the internal level (figure 1).

Figure 1. The Applications of the segmentation process

Figure 1 points out the fact that the segmentation continues to attract innovative persons in the company, which are often interested in the novelty of the different opportunities.

The Information technology and the database technology have improved so much that they can offer a new perspective on the segmentation process of the market. In accordance with the company’s strategy, with its innovative capacity and with its organisational structure, right now there are other types of segmentation: the valued based segmentation and time based segmentation.

The valued based segmentation has been imposed due to the fact that the clients' database allows the companies to establish a direct connection between the client segments and the company’s profitability. This type of segmentation is the mean by which the companies know and manage the clients’ portfolio.

Fortune Magazine presents the way the client portfolio is divided and the implications for the management of different client groups (figure 2).

For using this type of valued based segmentation, the companies must have a clear statistic regarding the transactions. Following the acquisitions made by the client there can be certain variables that can be identified: (1) the date of the last acquisition, (2) the frequency of acquisition and (3) the product value.

The valued based segmentation allows there fore the optimisation of the selling and distribution systems of a
company (the improvement of the marketing channels). The improvement of the marketing channel costs must be analysed from two points of view: (1) in the channels and (2) by the marketing channels. The improvement of the multichannel represents, the biggest opportunity for the majority of the companies.

Following this process a great value can be unlocked. The reason? The clients prefer different channels for different acquisitions (for example, receiving a service instead of selling a product or buying some additional options and not the main product).

Sometimes even though two clients buy the same product, it is possible that each one prefers a different channel (for example, a trip can be booked at a travel agency or the client can choose to book it via the Internet).

Because the transaction cost is different, new opportunities rise for transferring the clients towards new marketing channels. If well managed this situation can generate important earning for the client and for the company.

The multichannel improvement, based on the valued segmentation, is used by the majority of the market leaders and becomes an imperative option for all the companies because of the influence of the following factors:

- Increase of the client expectations;
- The more and more distinct use of the channels;
- The possibility of clients to manage the relations;
- The strategic competitive advantage (managing the channels assumes the management of the profits);
- The marketing channels costs;
- The client’s vision;
- The synergy.

The reduction of the costs for the clients by using a multichannel management, based on the valued segmentation, is not the only benefit. A company that practices a multichannel management can also benefit from other types of advantages:

- Has accurate information;
- Is capable of listening and of understanding the client;
- Understands the needs of the client;
- Allows the personalisation of the relation with the client;
- Allows the obtaining a feedback from the client.

The valued based segmentation allows the interaction of three main dimensions: (1) the characteristics of the segment, (2) the time and (3) the profitability (figure 3).

THE CHARACTERISTICS OF THE SEGMENT

- Who are they?
- How do they look?
- What do they need?
- How do they behave?
- What are they buying?
- Why do they want a certain product?

THE TIME

- The client’s life cycle
- The recent character and the acquisition frequency
- The client’s life stage
- The selected channels

THE PROFITABILITY

- The sums that the clients are willing to spend
- The actual sum spent at the time of the acquisition
- The service cost

Source: IBM – Institute for Business Value

Figure 3. The dimensions of the segmentation

Without a doubt, for each industry different variables are important. For example a hotel could consider much more useful the behavioural segmentation, giving much more special to the acquisition frequency and the type of acquired products of services.

*The time based segmentation* is another field in which the companies invest. Although this type of segmentation is rarely used, it becomes more and more important, especially on certain markets like the insurance field, were the clients follow certain annual patterns of auto insurance policy renewal.

The segmentation variables based on time are essential because they point out how the clients change as well as the acquisition stages. Thus for this type of segmentation allows the companies to solve the problem of the appropriate approached moment of the client. The time based segmentation allows the creation of an offer according to the following elements:

- How often will the client buy?
- How long will the client buy?
- Were is the client positioned in the repeated acquisition cycle?
- How much is the client ready to spend at this time?
• What will be the new needs of the client in the next period of time?
• How will the client generated potential profit be modified in time?

The presented types of segmentation are open approaches to all the companies, the winners will be those companies that will succeed in implementing them as effective and efficient as possible.

3. CONCLUSIONS

The difficulties faced by the traditional segmentation encourage the companies to adopt and implement the new methods of segmentation by using the data obtained from the transactions of the clients.

The new segmentation methods, presented in this paper, have forced the implementation of database marketing as a reality of modern marketing.

The strong development of the Internet in the last year has open endless possibilities for the companies to reach the clients. This new tool has brought closer the clients and the companies but in the same time it has become more difficult to segment the targeted clients.

More then ever, the future will point out a combination between the old and the new, between the traditional segmentation, as a result of marketing research, and the modern segmentation, as a result of database marketing, called by Paul Gamble the fusion of data.

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ABSTRACT: The fast rate of development of society, the globalization of economy, the obvious tendency to computerize all activity, the ever tighter blending of the economic and the political, the contradictory evolution of economic, social, political, cultural life, the tendency of informal elements (mentalties, ideologies, representations, stereotypes, myths, beliefs, prejudices...) to equal and even exceed the weight of formal aspects of organizations, the powerful development of trade union activities—are just a few features (with all implications springing from here) that mark modern society. In this complex picture, conflicts (interpersonal, intergroup, organizational, social, international) play a major role, constituting either an impulse for social-economic progress, or a definite hindrance to it. The need for familiarity with conflicts and their skillful exploitation arises, with a view to minimizing their negative, destructive consequences and to maximizing their constructive, positive dimensions.

Key words: conflicts, disagreements, conflict management, practical guide.

1. INTRODUCTION

If we refer to conflicts, the bad news is that they cannot disappear in any way from our existence. However, “the good news.... is that they represent simple and effective instruments for generating positive solutions and strong, genuine interpersonal relations” (Billikopf, 2004, p. 8).

„Conflict may be a life incentive and an energizer of the social environment. Actually, we can make it work for us” (Evans, 1992, p.12).

Counterproductive conflicts tend to occur in all organizations. Managers have to take into account how many resources (time, effort, money) they can invest in such conflicts and the way they might handle them. Whereas there is not yet a formal system for conflict solving, managers cannot ignore the fact that conflicts affect the economic and social functioning of organizations (Blackard, 2001, p.24). A successful leader needs some special ability more than any other: he must be capable of organizing and energizing the committed social actors, who already have concrete, well-defined tasks (Avery, 1999, p. 31).

2. CONFLICTS AND INTERPERSONAL CONGRUENCE

Inadequately handled, conflict may significantly affect the morale of the participants, their performance in task solving, ultimately, even the health of groups and organizations. Following increase in the time, effort and money used in handling conflicts, there gradually appears the ability to work with others, based on the attributes of team play. The capacity of participants to handle and solve conflicts increases, as a result, as a key to the success of both participants, as well as of the group and organization (Hignite, Margavio, and Chin, 2002, p. 69).

The complex processes by which each participant comes, in time, to know the other, to know about the latter as many aspects and details as possible, learning about the existing differences and, in turn, sharing with him his own experience and feelings, increase interpersonal congruence. Interpersonal congruence might be defined as the degree to which each participant sees the others exactly as they see themselves.

Consequently, interpersonal congruence should moderate the effects of diversity in the functioning of groups, allowing participants to attenuate these effects without abandoning their divergent characteristics and identities.

Interpersonal congruence and the processes of identity negotiation following from it are being built progressively, starting from the dynamic and subjective aspects of the partners’ perceptions. A high interpersonal congruence leads to harmonious and productive interactions for at least two reasons:

- When they feel they are perceived congruently, the participants are assured that the way they see themselves is the correct one. As a result, their feelings as to the coherence, predictability and control are consolidated / strengthened.
- Feeling that the others see them congruently, the participants will know what behavioral alternatives to choose and to what degree their interaction partners are able to interrelate with them. This means that this information facilitates social interaction and increases the chances of participants to fulfil their aims during the respective interactions.


Referring to the handling of conflicts, Richards speaks about intelligent conflict. It is that conflict which requires a high level cognitive and emotional commitment of the participants. As regards the cognitive side, we can project a series of rational techniques for problem solving, analyses, brainstorming-type activities. Under these conditions, we can assume that the participants are in a position to utilize such techniques successfully, which means that they are on the right way, the conflict being already half-solved. If we refer to the emotional domain, unfortunately it is more difficult to exploit. No efficient solution of conflicts can be achieved without the ability to engage in an authentic emotional experience with the others, which presupposes a temporary suspension of the needs, beliefs, opinions of the participants, so that they might direct themselves towards the areas of mutual interpersonal comfort shared with the others (Richards, 2004, p. 16).
Concretely, the finality of this complex and long endeavor is the increase in the mutual trust of the participants. In a very general acceptance, *interpersonal trust* is a multidimensional concept, including, in order of importance, the following dimensions:

- **integrity** - translated by honesty;
- **technical and interpersonal competence**;
- **loyalty** - the presence of good intention towards others;
- **substance** - coherence, predictability;
- **openness** - access to mental accessibility and the capacity to disseminate the available information (Baba, 1999, p. 41).

Cultivation and stimulation of trust among participants directs their efforts towards mutually supportive social conduct, of cooperation and assistance, the probability of disagreement and conflict being thus diminished or maintained at a tolerable, non-destructive level.

"Good managers know that the best way of approaching conflict is preventing it and, when that is not possible, intervening" (Savage and Hilton, 2001, p. 18). It is possible and beneficial to make the conflict productive rather than disruptive, the secret consisting in activating some processes that yield acceptable solutions for all the parties involved.

### 3. CONFLICT MANAGEMENT STYLES

Starting from the well-known, in social and organizational psychology, managerial grid worked out by Blake and Mouton (1964), five styles of interpersonal conflict management can be noted, conceptualized in various instruments, as follows:

- **Avoidance** - the participants do not wish yet to openly assume disagreement / conflict;
- **Adjustment** - refers to overlooking existing differences and concentrating upon the areas of agreement, with a view to maintaining a positive interpersonal relationship;
- **Competition** - each participant tries to attain his objectives, to the detriment of the others, but within a firm normative framework, which prevents escalation of hostility and aggressive-type conduct;
- **Compromise** - each participant partially concedes (temporarily renounces his initial requirements), with a view to finding a solution that is acceptable for both parties;
- **Collaboration** - refers to using problem-solving mechanisms for a direct approach to existing differences.

Attempting another perspective, the resolutive approach to disagreements and conflicts implies three fundamental conditions:

- **Knowledge** - refers to participants’ awareness of the existing disagreement;
- **Acceptation** - participants assume the perceived disagreement;
- **Adjustment** - the solution of problems is attempted.

Two principles have contributed significantly to conflict management (Billikopf, 2004, pp. 8-10):

- **Try first to understand, so as to be later understood by the others.** Encouraging the others to first explain their perspectives and points of view, they will be much more open to listening to us.
- **Reaching an agreement.** This is, ultimately, the aim of any strategies and actions of the participants in a conflict, the real thing at stake.

### 4. STRATEGIES AND TECHNIQUES IN MANAGING CONFLICTS

We consider it useful, at this moment, to enumerate some strategies and techniques that might be beneficial in solving disagreements and conflicts:

4.1. Participants in disagreement must focus on *needs* rather than on positions taken temporarily. Their concentration on positions leads to a tendency to overestimate/accrue the existing disagreement. Focalization of participants upon needs and terms leads to awareness of the fact that they share more things than they initially assumed, the meeting of the sum of participants’ needs being ensured (of both one and the other). The participants thus become aware of the non-null sum of the interactions, in other words, they realize that it is not necessary for one to lose so that the other might win. Participants acquire the certitude that they can solve the disagreement by mere compromise. In fact, the basic objective of any disagreement/conflict must be not the victory of one party over the other, but obtaining an acceptable agreement/compromise for both parties. Under these circumstances, both parties may be winners. Participants can learn how to maintain the channels of communication open and to solve their disputes when things are not as they wish them to be.

4.2. Concentration of participants upon solving the existing problem and not upon possible solutions is, also, an efficient resolutive strategy (Billikopf, 2004, p. 40). When one of the participants comes up with a solution to the assumed disagreement, even if that solution is really good, he induces in the others the impression that they have lost control of the situation, that they have no control over the results, which pushes the conflict up on an ascending circuit, ever harder to solve.

4.3. As the conflict affects the participants in many ways, another possible and efficient strategy is that of blaming the conflict itself and not the participants (the situation itself is to blame, the conflict itself, not the participant, in any way). This resolutive strategy based on avoiding personalization of conflictual situations, allows keeping or recovering self-esteem, preventing the others from becoming defensive.

4.4. Distancing of participants from the conflictual situation, the latter being already suprasaturated emotionally to be considered rationally, with some detachment (Billikopf, 2004, p. 13). A depersonalization of the situation thus occurs. In other words, this means avoiding the traps of emotional reactions and the attempt at remaining within the rational sphere as well as understanding the nature of the problems and disagreements before the aggression is launched. Approaching problems and personalities is an endeavor that is just as dangerous as open attack upon the opponent. If the latter feels threatened, he will be mainly concerned with defending his self-esteem, which will make him approach inadequately and inefficiently the existing disagreement, his contribution to the identification of mutually satisfactory solutions decreasing thus dramatically.

4.5. Keeping within the framework of possible solutions for an adequate solving of the conflict, we can also mention focalization of participants upon future conduct and not upon past hostilities and injustices. The sooner the participants manage to focus on future interactions, the greater the chances for an efficient solution of the conflict. Obviously, this strategy is valid only for the participants who already have a shared history, a shared past. In this context, knowledge of the past is
essential for an analysis of the pattern of the conflict, so as to assist participants in finding constructive modalities of approaching future disagreements, they making thus ready for them.

4.6. Seeking an integrative solution (orientation of participants to win-win type solutions). The above-mentioned approach to disagreements/crisis significantly increases the probability of identifying solutions that are satisfactory to all participants involved. It means to identify further alternative strategies such as minor concessions, which may, nonetheless, be strongly turned to account by the others, working out of options in terms of the other participants’ interests, the building of the appearance of alternatives that should allow the partner to declare his victory, manifestation of constant interest for the others’ interests. Even when there seem to exist a winner and a loser, most often the social environment offers surprising solutions, of the win-win type, with advantages (even if substantially unequal and differentiated) for both participants in the interaction. Most often, the win-win –type approaches materialize in solutions such as consensus and integration. Definitely, consensus is ideal, but it is, unfortunately, very difficult to obtain, requiring considerable waste of time and energy (Richardson, 1991, p.83).

4.7. Working out a plan before interaction proper, based on clarification of own aims, positions, and interests. In other words, it is extremely useful to know whether we are in a win-win type social situation or, on the contrary, in a win-lose type one. Also, we take account of the attempt of the participants to accurately establish the best possible solution, the real aims and problems of his own person, but also of the other, what exactly is correct/just and what is unjust, as well as what can be considered acceptable for both parties involved, the advantages and inconveniences of the situation for both participants.

4.8. Identification of subjacent interests. It means both clarification of subjacent interests and needs and, especially, sending signals to others relating to this, finding existing common points between participants and minimizing apparent differences between the interests and needs of the participants.

Efficient use of these instruments, strategies and techniques for the efficient management of conflicts are the result of a complex and dynamic process of social learning, starting from the well-known mechanisms of positive and negative feedbacks. In the future, social actors will select only those behavioral alternatives, attitudinal orientations, problem-solving mechanisms that have proven efficient, beneficial in the past, while the attitudinal, behavioral orientations, the resolutive strategies that have not allowed fulfilling the aims pursued will be avoided in future interactions.

As a direct result of social learning, social creativity of individuals and groups is thus activated, in a continuous exploration of the social environment, with a view to identifying the most beneficial and efficient actional alternatives for the management of disagreements and conflicts. „Nothing kills creativity sooner than fury, pride, embarrassment, envy, greed or other strong negative emotions...These emotional short-circuits tend to promote rather than to solve conflicts. If we can improve our ability to handle our emotions and to respond (to other people’s requests— a. n.) without getting defensive, we can start on the long way of creative negotiation” (Billikopf, 2004, p.37). In the social environment, „creativity requires particular respect for forces and phenomena that appear chaotically, confusedly and irrational” (Beech, Cairns and Montuori, 2001, p.41).

Differences in power, personality or self-esteem that existed between participants can sometimes lead to such strong disagreements that they require the intervention of a third party, namely the mediator. Even in this situation, in any mediation process there are many points of maximum sensitivity, which seem to direct matters in a really unwished for direction, unsolvable and final, the only hope being the mediator’s capacities, experience and exceptional training.

5. THE MODERN SCIENCE OF CONFLICTS

While 10 years ago it used to be estimated that managers spend 18% of their working time trying to solve the conflicts of employees or at least to keep them within controllable and acceptable limits, presently this percentage seems to have doubled (Hignite, Margavio, Chin, 2002, p. 11). Conflict management has thus become a priority component of many academic programs, there existing, internationally, many institutions and organizations (most of them in the USA, but not only, focusing on the alternative solution of disputes, as well as on mediation) exclusively concerned with this phenomenon.

Conflictology, as a modern science of conflicts, is at present pursuing a process of self-assertion and evolution, evidently tending to structure itself as a self-sufficient discipline of the beginning of the millennium.

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ALUMNI – A STRATEGIC RESOURCE FOR UNIVERSITIES

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ABSTRACT: Alumni constitute an important human and social capital that universities can leverage, through an appropriate strategy, to create institutional-societal shared benefits. The paper is based on a literature and worldwide practice survey, to reveal the strategic potential of alumni associations, and how universities may, and should capitalize on the relations with their alumni.

1. INTRODUCTION

In this age of globalization, with information technology and communications prevailing, organizational change, individual change, and changing concepts and attitudes translate an absolutely necessary adjustment to pressures from outside and inside, from interrelations at all levels and in all areas. Change is the key word of this time, its rate and the scope of its manifestations being increasingly difficult to sustain and control. Networking between individuals and organizations is happening to an ever greater extent in the virtual environment, corporate activities and structures are acquiring global scope, and resources are the name of the game. Power play gets greater emphasis and is exerted in increasingly sophisticated forms. Meanwhile, it is more and more difficult for the planet to accommodate and put up with us.

Therefore, the measure of individual and corporate or collective wisdom is given, now more than ever before, by the availability to change and adapt to new developments; by the reaction speed and flexible response to challenges; and by the ability to predict trends and position accordingly, in a correct and proactive manner. In this respect, we believe it is time for academia to respond to the growing challenges and to assume greater responsibility in securing such balance as could still give mankind the prospect of a viable future.

At this point mankind has no choice but to reconsider its values and priorities and repossession itself accordingly. Beyond the natural resources the Planet Earth provides, humanity’s most important resource is the human resource – through each and every one of the individuals making up the human race, as a potential pool of brainpower and action. It is obvious therefore that the best investment humankind can make to ensure its sustainability [1], i.e. sustainable development [2], is to capitalize on this resource, based on education and continuous learning, on lifelong training and improvement.

In this approach, academia is where research starts and develops – knowledge, discovery, innovation, but then also the propagation of scientific breakthroughs, the shaping of abilities to apply them. Academia also generates and fosters individual and organizational, and social values, as well as the power to anticipate development trends and either to preclude or use them as challenges for evolution or even to generate such opportunities. That is why academia’s mission in respect of human resources and its role in the future of human communities is crucial.

This being so, we believe universities, too, are organizations supposed to change and exposed to change. As their positioning and mission is crucial in determining the future of humanity, they should be the first to foresee change, prepare society to take the change in its stride, and set an example of responsiveness and sustainability. To this end, universities will have to identify themselves as learning organizations, including also on how to best turn all their resources most efficient using into a competitive advantage.

In view of the above, this paper is aimed to sensitize academic management in the Balkan region to the importance of strategically capitalizing on an almost unconditionally and handy available, but still underused, human resource: alumni.

2. ALUMNI ASSOCIATIONS - IN THE WORLD AND IN THE BALKANS

Alumnus (pl. alumni)/ alumna (pl. alumnae) is the noun designating the status of graduate or former student of a school, college or university, or any other form of education, or their community [3].

An Alumni Association [4] is an organized group of alumni, of former students of an education form/ structure. Most such associations are independently organized structures, often legally registered, having their own headquarters, statute, rules and regulations, leadership and possibly even insignia. Most alumni associations are formed around universities or university departments, around student groups sharing a certain pursuit (sport, art, science, specialization, membership of a specific group, etc.).

In United Kingdom, or Scandinavian countries, membership in such a community is almost inherent: connections are created and maintained unconditionally, as part of the cultural specificity and particularly of the ethos of the academic world, of clubs and elitist groups.

In America, socialization by setting up associations comes so naturally that individual existence, at any age and level, is inconceivable without affiliation to and membership in a group, which serves as identification and landmark. But such affiliation also involves aspects of mutual benefits [5].

With respect to the integration of academia in the broader community and the ways this can serve the interests of the society, in Japan or even in China the situation is somehow similar, although the underpinnings are different.

In Europe, alumni associations are getting greater attention now, while their popularity growing as universities’ subsidies
from the public budget declines, and their financial support depending to a growing extent on relations with and integration in the civil society [6].

In the Balkans, alumni associations, as publicly presented on the Internet, are few and act only as a framework for recording remarkable alumni and organizing anniversary reunions. Therefore their activity is occasional and absolutely formal. They virtually do not foster community or inter-institutional relationships with the alma mater, or else a form of mutual assistance and support, let alone a common evolution, development and differentiation. A first search on the Internet [7] produced the following results regarding the Balkan region:

Table 1. The quick internet overview results on registered Alumni Associations (AA), in the Balkan region

| #  | Country               | Number of AA*
<table>
<thead>
<tr>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Albania</td>
<td>1/ Tirana</td>
</tr>
<tr>
<td>2</td>
<td>Bosnia &amp; Herzegovina</td>
<td>1/ Sarajevo</td>
</tr>
<tr>
<td>3</td>
<td>Bulgaria</td>
<td>1/ Sofia</td>
</tr>
<tr>
<td>4</td>
<td>Croatia</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>Greece</td>
<td>2/ Athens</td>
</tr>
<tr>
<td>6</td>
<td>Macedonia</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>Montenegro</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>Romania</td>
<td>9</td>
</tr>
<tr>
<td>9</td>
<td>Serbia</td>
<td>1/ Belgrade</td>
</tr>
<tr>
<td>10</td>
<td>Slovenia</td>
<td>1/ Ljubljana</td>
</tr>
<tr>
<td>11</td>
<td>Turkey</td>
<td>14</td>
</tr>
</tbody>
</table>

* These AA numbers refer (only) to indigenous organizations

With just a few exceptions, where an alumni association exists, it is to be found in the country’s capital city. And while Turkey and Romania stand out, this is related not only to the size of these two countries and implicitly the number of their academic institutions, but also to their contact and connections with the academic world abroad.

However, as if by compensation, we found it very interesting that, precisely in the countries whose higher education system is less developed, there are notable associations of local alumni of foreign universities (e.g.: Cork, St. Thomas, Syracuse, Washington, North Carolina, Auburn, La Salle, Buckingham, San Diego, Manhattan, Queens, Oxford, Zurich, Vanderbilt, Illinois, Windsor, Princeton, Oakland, Seattle, Bristol, Minnesota, Oregon, Stanford, Drexel, London, Newcastle, Wisconsin, Michigan etc). Such alumni associations are either zonal branches of the alma maters in the countries of origin or independent associations related to the branches of the respective universities operating in those Balkan countries.

These remarks reveal that a nation’s cultural specificity also shows in the aspects approached here. But, obviously, the way a certain academic institution considers and uses the alumni resource depends almost exclusively on its management. Consequently, university networking, as illustrated by alumni associations, occurs in many forms and at various inclusion levels.

Another, still more significant observation is that, almost symptomatically, the more developed a higher education establishment, the stronger is the alumni community related to it.

3. BENEFITS OF ALUMNI NETWORKING

The usual, prevailing goals and actions of alumni associations and the alma maters, in their partnership, are:

- to organize events (reunions, conferences, social events); for instance, Washington State University/ WSU has the most impressive schedule, in point of both variety, scope and type of events, everything being presented by month, day, time and venue, at least six months in advance [8];
- to raise funds (modalities and justifications); in this respect, Harvard University is maybe the world’s top performer: not only does it operate with an annual budget of 32 billion USD, from alumni resources included (in varied forms: direct contributions, contracts for various services, scholarships, prizes etc.) but it even has a (strategic) plan to attract, manage and channel the funds from alumni donations/ contributions [9];
- to promote certain personalities (VIPs) – alumni who reached holding top-chelon positions or academic titles;
- to issue bulletins, books or other publications; this is roughly the most frequent way of maintaining relations by promoting outstanding alumni and also serving as marketing (direct or indirect) of the alma mater;
- to facilitate forums for networking and communication by providing, for instance, a free e-mail address for life to all alumni, supplying annual reports or quarterly bulletins, inviting them to anniversary or specific events etc.; an example in this respect is MIT [10], but then many other universities, especially from US;
- to recruit talent and/ or personnel (notably for corporations);
- to ensure partnership-based cooperation and affiliation to networks (NGOs or professional, national or international networking, affiliation to certain bodies);
- to offer a framework for creativity, in support of scientific activity, learning improvement, career development (ideas, case studies, proposing project themes etc.); an example is the United Nations Association of the United States of America (UNA-USA) - where world politics and how to react to it is learned and experienced in an institutional framework, through thematic simulation exercises [11];
- to launch and conduct public surveys – opinion polls/ questionnaires; many universities and/ or alumni associations frequently resort to this method to identify possible ways of networking improvement and even of revising management strategies/ action plans;
- to provide support to students, including scholarships and excellence prizes, or carrier orientation and promotion, as well as assistance on retirement plans, memory boosting, travel facilitation, fitness, visiting, leisure, hobbies, action in crisis situations etc.; a noteworthy example is WSU, with its special policy on senior citizens;
- to motivate the community toward involvement in matters related to the respective university/ academic campus and the values, standards and principles defining it; examples are provided by both WSU and MIT but also Princeton, Yale, UC Berkeley, Stanford, Rochester, Pennsylvania, Cornell, University of Florida – also by programs of Educational Travel Conferences [12].

In a nutshell, it can be noted, based on a diagram summing up a statistic evaluation conducted on universities from US [13], that the role of alumni can be defined in a simplistic way by a number of major coordinates – to be viewed also as a measure of success if percentages are considered:
Figure 1. Areas of alumni involvement

Generally speaking, alumni are viewed as a target group of professionals and consumers, in recruiting talent [14] and clients [15], contributors to charities, or users of technological advances [16], in the conduct of marketing research or organizational performance surveys [17], in fostering interest in innovation, and luring them to act as an incubator of ideas under a university umbrella [18], direct corporate marketing, through publicity for maintaining ties with the university and sponsorship, but also in promoting products for academic use – communication with alumni [19] and social networking [20], as to enriching knowledge and community building, opinion shaping, or stand taking on a theme of shared interest [21] etc.

To note, however, that the university-alumni relationship is generally viewed, understood and approached, through practical and communication actions, as a bilateral reciprocal one. Irrespective of when, how and where the initiative of university-alumni networking started and regardless of the way it was constituted and instituted, the concern to maintain and develop this relationship and interaction, certainly where and when it exists, is perceived, conceived and manifested as an organizational, strategic management effort of both the university and the alumni association/group. When a university has a strategy and a plan on what it wants to obtain from alumni associations, then it will also see to what it can offer them, pursuing to best position itself in a mutually beneficial partnership, or anyway a mutually motivating and profitable relationship. While alumni associations are usually grounded on mutual agreement between former college mates to keep in touch, alumni groups concurrently promote a sense of belonging to the credibility and repute capital of the alma mater. That is why management of alumni associations/groups that is not self-reliant is also geared to maintaining and developing ties with the university, as a way of showing gratitude for the professional training the alma mater provided, as well as interest in affiliation to an academic community with which alumni identify through pride and even loyalty.

4. CAPITALIZING ON ALUMNI – IN THE BALKANS?!

Reverting to the situation in the Balkan region, it can be noted that here the phenomenon of alumni associations being set up and existing is not only almost accidental, but also lacks support. Besides, the context, insofar as there is a specific context for alumni associations, is quite different from western practices, basically on account of mindset characteristics. Should we refer to the ethos, to the Romanian culture, unfortunately communication and community unity do not characterize us except perhaps when it comes to a very conditional and transient mobilization in face of a major common threat. Otherwise, it is individualism [22], alienation, egocentrism, mistrust and suspicion, pessimism and passivity, which are prevailing [23]. It is not in our nature to act in common and combine our efforts for the collective good (we know little of it, cannot grasp it and do not really serve it). Neither does mutual aid characterize us, particularly in its Samaritan aspects of financial support. Moreover, in the mainstream mentality, any initiative of asking for funds is associated to humiliation, pauperism and degradation.

Furthermore, it is quite shocking how everyone seems to agree that education, like many other areas of social and community interest, is exclusively an obligation of the state, in point of funding, and if the state cannot adequately fulfill this obligation, we, the citizens, and society/ the community as a whole can do nothing, except possibly go on strike. In our opinion, especially at the academic level, this approach should not be the only way we can see things, on all we can do.

Resignation or demobilizing are not solutions of success, let alone of setting value examples, as academia is expected to.

In our opinion, samaritanism, charity, as we can learn from western experience, need to/ can be trained and cultivated. More important still is to change thinking patterns, the wait-and-see attitude, the inertia of dependence, the shunning of responsibility and self-responsibility, the tendency to ignore certain realities, or the immobility of paradigms.

We believe it is important to mention that necessary change tendencies at the academic level are in part identified in the strategic analyses of certain western universities generally acknowledged as prestigious. For instance, Prof. Colin Mayer, Dean of the Business School at Oxford University, opines that if they are to secure their institutional existence, European universities have to reconsider a number of cultural paradigms concerning alumni and funding, but also concerning the evolving strategic management of organizations [24]:

“In Europe, education is traditionally viewed as something the state pays for, with the idea of relying on donations anathema. The view is very different across the Atlantic, and this is something that European schools are going to have to get to grips with if they are to continue to compete in harder times. In the new economic climate, schools have as much need to adapt as corporations. Partly it is to prove that the alumnus has an ongoing relationship with the school; that we can provide lifelong learning to them; that it creates a sense of community.”

Surveys indicate that students are anyway taking the lead when it comes to change, both in approaching the idea of alumni and in point of their perception of the relationship with the alma mater [25].

On the other hand, the community, the business community in particular, is establishing new connections and developing new expectations as to what the university can offer [26]. In this respect, the University of Kyoto, for instance, acknowledges and has assumed the managerial responsibility of serving the community and common progress, based on strategic partnership either with the international community [27] or with the business one, on the national market, or with administration and government bodies, to the societal benefit.

In this line, so long as facts, statistics, indicators and measurements prove that investing in alumni benefits the university – with its image, with ideas, human potential, financial resources and material support (sponsorship, and/ or
donations), continuity – and society alike, through the assistance the university provides and the impact education has on society, we see no reason why academia in our region, should not take advantage of it. General world experience demonstrates the usefulness of this approach and attests that it must be cultivated.

Therefore we consider it necessary to sensitize academic management structures in the Balkan countries as well about a this (alumni) multivalent resource that is readily available and could be capitalized on to obtain multiple benefits, a multiplier effect both in the domestic and in the international environment.

With respect to methods (to do it), world experience is a source of information and inspiration, very useful, accessible and long proven in practice. Naturally, culturally specific, local approaches can be developed and initiated, along with approaches borrowed from foreign academia and the international community, adapted to the local spirit. It is important to keep in mind that there are things that can be done quite easily but with large benefits, things so natural that we may neglect them.

A great advantage in the Balkan region comes, we believe, from the fact that, with foreign assistance flowing in since the transition to free market economies, and, then, when the integration in the European Union began, more and more facilities are created for exchanges and common educational programs with universities of world repute. In addition, within the trends of globalization and even the current crisis, academia has a growing role in meeting challenges and capitalizing on the opportunities to invest in the human resource potentials, as factors of institutional sustainability, for a sustainable development [28]. This, we believe, could be a tremendous opportunity for universities, as organizations, to reappraise their resources, reposition socially, and design management strategies geared to sustainability [29]. In this process, alumni can be an invaluable success factor, both as a human resource to be capitalized, to the academia’s benefit, and as its agents of change, for the community’s improved prospects for sustainable development.

5. CONCLUSIONS

While, broadly speaking, engineering means application of scientific knowledge and practical experience in order to create or design useful objects or processes [30], for organizations it means to conceive and implement them to be as functional and efficient as possible. Organizational management, on the other hand, refers to the action of managing the organization or all the processes, as well as the teams and groups of the organization most efficiently, to obtain maximum results by optimally using all (available or potential) resources [31]. In a long-term approach, this is equal to strategic management [32]. In recent years, however, this has been called towards sustainability, i.e. ensuring an organization’s prospect to have and maintain indefinitely a competitive advantage positioning [33]. Since any organization’s most important resource lies in the human capital, it follows that sustainable evolution is most likely to be achieved by organizations that most efficiently manage their human resources (actual or potential); moreover, sustainability also depends on how much the organization shall invest in best maintaining and permanently developing this (most special) resource.

As far as academic institutions and alumni as resources are concerned, this means that any university that succeeds in attracting former students and efficiently managing the relationship with their community stands good prospects to its sustainability.

As highlighted throughout the paper, alumni represent a human resource in the broadest and most comprehensive acceptance of the concept, an inexhaustible carrier and generator, at the same time, of all other resources – financial, informational, material, technological – but also of public image capital, community support and innovation. Consequently, to any alma mater, alumni represent a strategic resource. And it is up to the academic management to put this resource to good use, strategically, in the service of the institution and of partnership, of mutual benefit in the long term.

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INFORMATION QUALITY – A VITAL TOOL FOR THE INFORMATION AGE

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ABSTRACT: The goal of this paper is to highlight the role of Information Quality (IQ) in intensifying the competitiveness and making organizations more efficient. The paper is based on IQ literature on practical experience in diverse information system (IS) related area, and research. At the beginning, the article presents some theoretical aspects regarding Data and Information Quality – a multi-dimensional concept – and emphasizes the importance of increasing the value of high quality information. This paper reports the findings of a quantitative research conducted in 2008, on managers and organizations from the 7th Center Region, in order to investigate the dimensions which can be applied to measure quality of information in the context of its use. The paper is important for executives, practitioners and students in order to understand how to investigate and solve information quality problems.

1. INTRODUCTION

We live in the an Information Age in which more and more organizations understand that what they did not know becomes the Achilles heel, that what they do not understand can be transformed, at any time, into a source of advantages for the competition. In the context of the complexity and of the dynamics of the environment, the organizations acknowledge that for achieving their goals the financial, human and material resources are not enough.

Today more than ever, the organizations use the information and the knowledge in order to obtain sustainable competitive advantages. The vital role of the information can no longer be contested under any circumstances. In the new age, the power will largely depend on the access to information and knowledge and also on the individuals’ capacity and the organizational capacity to effectively exploit them in order to obtain competitive advantages.

If we acknowledge that the information and the knowledge are vital resources for any organization, then we have to recognize the fact that it is necessary to fully clear a series of aspects linked to the specific elements of the information age in which we live in: Who are the persons that have the valuable information? At what price can the valuable information be obtained? Who manages the information? What are the benefits that the information generates for the organization? What information do I need, in what form and when? What are the characteristics of quality information?

This paper aims to educate people – managers and professionals – about the critical issues in data and information quality that could have negative consequences for organization performance. This paper also offers a comprehensive overview of information quality issues that can be used by senior executives, line managers, IS analysts, information quality managers, quality assurance managers, data warehouse managers and data administrators.

It is the purpose of this paper to highlight the idea that if an organization is to achieve its goals in the current Information Age, the managers have to be supported by high quality information. The issue of information quality has become very important over the last years as the amount of data being collected and stored by the organizations continues to increase at a rapid pace. However, the enormous growth in quantity of data has brought with it growing problems with the quality of information [16]. Almost all businesses, government institutions, educational institutions, hospitals have been hurt by information quality problems. All organizations today confront data quality problems, both systemic and structural [9]. All of us have suffered the consequences of poor-quality information. Sometime the impact was indirect and had minor significance, at other times poor-quality information has direct and long-term negative consequences. Poor data quality can seriously hinder or damage the efficiency and effectiveness of organizations and businesses [1]. Every business operation creates or consumes huge quantities of data. If the data are wrong, time, money, and reputation are lost. In today’s environment, every leader, every decision maker, every operational manager, every consumer, indeed everyone has a vast interest in data quality [11]. In real world there are companies that have faced million-dollar losses as a consequence of the poor data management, as well as industries leaders who have prospered through Total Data Quality Management [4].

Data quality is an increasingly critical issue facing organizations [6, 8, 7]. Data quality (DQ) and information quality (IQ) are becoming the new buzzwords. Many academics make the distinction between data and information and the issue of what is the difference between data and information is often raised. The traditional distinction between data and information is that: data comprises raw facts or materials, and information is data that has been processed. The data for one person may be information for another. Taking into account these differences, and many others, some academics insist on distinction between data quality and information quality.

Although that in the scientific literature there is a clear distinction between the two concepts, we have to point out that most information system practitioners use the term information quality synonymously with data quality [3]. Drawing an arbitrary distinction between data and information can distract managers from understanding the complex information system. Because the ambiguity often arises, and because making a distinction is not very important to the subject we discuss here, we use the terms data and information interchangeably through this paper.
Most commonly, the term „Data Quality” is described as data that is „Fit-for-use” [15], taking into account the context of user, environment and task [12]. Information quality is a complex and multi-faceted issue. IQ is a measure of the value which the information provides to the user of that information (Wikipedia). Information on its own is neither inherently good nor bad. „Quality” is subjective and the quality of information can vary among users and among users of information as data considered appropriate for one use may not possess sufficient attributes for another use [13].

In the literature, it is accepted that Data and Information Quality is a multi-dimensional concept [5] with varying attributed dimensions depending on the author’s philosophical view-point. Among the dimensions often evaluated are: accuracy, completeness, consistency, accessibility, and timelessness [2]. Wang and Strong [14] carried out the first large-scale empirical research design to identify and understand the dimension of the data quality from the perspective of the users of data. The framework developed by Wang and Strong includes four domains and fifteen dimensions: (a) Intrinsic IQ – Accuracy, Objectivity, Believability, Reputation; (b) Contextual IQ – Relevancy, Value-Added, Timelines, Completeness, Amount of Information; (c) Representational IQ – Interpretability, Ease of Understanding, Concise representation, Consistent representation; (d) Accessibility IQ – Accessibility, Access security.

2. RESEARCH REGARDING THE EVALUATION OF QUALITATIVE CHARACTERISTICS SPECIFIC TO THE INFORMATION

The survival of the organizations in the information age, in the context of continuous changes that take place, will decisively depend on the quality of the collected, stored, processed, and transmitted data by the information systems. Taking this matter into account, we have developed a research that aimed to determine the manager’s opinion regarding the quality of the information used by the information systems implemented by the organizations. Having a relevant experience both in management and in IT field, we developed the research in the framework of a larger project regarding IT implementation.

Starting from the studies and the researches of the specialists in this field – all were pointed out previously – we have created a list of all the IQ dimensions, which were debated in a workshop. In this exploratory study, opinions were collected by interviews with 25 managers and IQ specialists from 15 companies in various industries. Following the exploratory study we have pointed out ten dimensions that the information should have in order to be considered of quality and that were subsequently verified with a survey – a quantitative method, through an anonymous questionnaire. The questionnaire was pre-tested by 10 companies and improved and finalized based on the feedback.

The sample of the study conducted in 2008 has been represented by 150 managers from all type of companies (big, medium, small and micro enterprise), operating in different industries (manufacturing, service, commerce) and located in Romania, Region 7 Center (six counties: Sibiu, Brasov, Alba, Mures, Harghita, Covasna). The companies were randomly selected in order to cover all type of companies (were classified taking into consideration the field of activity, the company size, and the company revenue).

In our survey research, independent variables were measured by a nominal scale and for dependent variables was used a five-point Likert scale ranging from 1="strongly disagree" to 5="strongly agree".

This paper present one main objective of our research: To identify the manager’s opinion towards the information quality. The research includes ten traditional dimensions that come out of the exploratory study: Accuracy; Completeness; Timeliness; Concise; Reliability; Understandability; Accessibility; Availability; Objectivity; Relevancy; Usability; Security.

a) **Accuracy** – the degree to which data accurately reflects the real-world object or event being described. It is the extent to which data are correct, reliable and certified free of error. The information has to be accurate enough in order for the user to rely on it in achieving its goals. But in the same time if there is a high level of accuracy this can lead to an increase of costs. Still there are numerous cases in which the increase of accuracy does not lead to an increase in the value of the information. At an operational level the information must be extremely accurate, at the tactical level the information can be rounded off at a small level and at a strategic level the information can be rounded off even more.

b) **Completeness** – the extent to which information is not missing and is of sufficient breadth and depth for the task at hand. Ideally all the information required for solving a problem or taking a decision should be available, but, unfortunately in the real world this rarely happens. In order to completely and fully identify the key factors there has to be a strong connection between the suppliers and users of the information.

c) **Timeliness** – the extent to which information is sufficiently up-to-date for the task in hand. The speed that information is required seems to depend on the seniority of the person requesting it. The relationship between the position of the information user in the organisational hierarchy, and the speed at which they are provided with information, often results in information being made available in totally the wrong places at the wrong time.

d) **Concise** – the extent to which information is compactly represented without being overwhelming (i.e. brief in presentation, yet complete and to the point). A high level of conciseness implies increased collection, processing and transmitting costs, which does not mean that the quality of the decisions will be higher. The level of conciseness depend on the hierarchical level: at a operational level, the information must be extremely detailed but at the tactical and top level the data must be much more concise.

e) **Understandability** – the extent to which information is clear without ambiguity and easily comprehended. The understanding is extremely important because it helps at the transformation of the information into data. If the data is not understood it can not be used. There are several important factors that influence the level of understanding: the preferences of the user – some users prefer the information to be in a table or a drawing or a chart and in the same time other users prefer the data to be presented in a narrative structure. In the development of the information system we have to consider the preferences of the user in order to deliver the message according to the users request; the perception – this is an individual process that is different from individual to individual and further more it can vary in the case of the same individual; the language – the information is send with the help of signals and messages. The information can be encoded or be presented in an natural language, that often can be ambiguous; the retained knowledge – the researches made in this field have shown that the retained information can
help and can influence the level of understanding; the environmental factors – there are several factors, like the pressure of the groups, the available time or the trust in the informational system, that influence the level of understanding.

g) Accessibility – the extent to which information is available, or easily and quickly retrievable. The information must be presented in a structured manner. It should be accessed according to the hierarchical level of the user and the level of detailed data should also be according to the user.

g) Believability – the extent to which information is believed by the persons/users that manage the information. This means that the information must be presented in a credible manner, the information must be sustained by actual facts and the person that needs and receives the information must be convinced that the data presented to him is accurate.

h) Objectivity – the extent to which information is unblessed, unpredjudiced and impartial. The information must be presented in such way that it does not influence the decision or implies it in the presentation. All the information must be correctly, accurately transmitted to the decision makers.

i) Relevancy – the extent to which information is applicable and helpful for the task at hand. Unfortunately this aspect is often overlooked. Many reports, tables, charts and messages often contain irrelevant information that make the understanding process much more complicated and therefore the user can become frustrated.

j) Security – the extent to which access to information is restricted appropriately to maintain its security. In all information system a level of security must be maintained. It is very important that the data or the information transmitted reach only the designated user. In order to achieve this it is very important that security restrictions are implemented and access to the information can be done only after following certain security procedures.

Following the analysis for each of the ten characteristics, the scores obtained (using the Likert scale) are between 2.39 and 3.53, and the global score – obtained on the base of the scores calculated for the ten dimensions – is of 2.71, which points out that there is a disadvantageous perception, but close to neutral, on the quality of the information used by the information system. Consequently, the hypothesis that was issued at the beginning of the research – the information used by the information system are of an average quality – has been confirmed.

In order to have a better and a larger picture on the analyzed characteristics, a synthesized graphic representation of the obtained scores has been created (figure 2).
The analysis of the results points out that the biggest problems and discomforts are generated by: Timelessness, Concise and Security (in these cases we have the lowest scores: 2.39; 2.57 and 2.70). As it can be noticed, the highest score, and consequently the best appreciation are for the characteristic that points out the fact that the information is presented in an accessible language (3.53).

3. ACKNOWLEDGEMENTS

First, this research was carried out only in one region from one country (Romania, 7th Center Region, with six counties). Second, the sample size on which the results were based was relatively small and the results cannot be generalized. Third, data were collected at one point in time. The cross-sectional nature of this research means we are not able to draw casual conclusions. Future research should focus on longitudinal studies to understand the process over time, and to allow stronger conclusions. Therefore, further studies in the field are needed.

4. CONCLUSIONS

Right now, more and more organizations and managers recognized the information as a vital resource. It has value and in influences, in a definitive way the efficiency and the effectiveness of organizations and businesses. The information is, for all the organizations, a vital resource, a precious asset and an important power factor.

In the new age, in order to obtain competitive advantages, the organizations will be forced to become informational-intensive. They must be able to collect the information, to process it, to analyze it, to interpret, to disseminate and to properly use and integrate it in all the products and services that the organization provides.

Another interesting aspect is linked to the quality problem. Although the majority of the organizations recognize the necessity of implementing the quality management, still few organizations take active measures in order to evaluate and then to improve information quality.

If there is no quality information, it is possible that the managers and the employees will make mistakes, will lose opportunities and will face serious problems with regard to performance. Right now, in the condition of globalization and of fierce competition, in order to achieve business excellence it is important to measure and to improve the quality of information collected, stored, processed, and transmitted in organizations.

In the Information Age, the people have to be made aware of how important the quality of information is. The performant information systems can become real competitive advantage sources.

They facilitate the improvement of the performances and make possible the achieving of a superior efficiency and effectiveness level. Often to the information system unrealistic expectation are attached. One of these unrealistic expectations is that the information system offers valuable information to the managers, in order for them to take better decisions.

Unfortunately, in practice, this does not happen very often. Many managers complain for poor data and information quality. There is a consistent gap between the users’ expectations regarding Information Quality and the perceived quality of the information they are using. These aspects related to the used information quality in the managerial information system have been pointed out in the selective research that highlighted the quality of a low IQ dimension score.

5. REFERENCES

HCI (HUMAN COMPUTER INTERACTION)
APPLICATIONS FOR EDUCATIONAL PURPOSES
HOW TO LEARN A BIPED ROBOT TO WALK

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ABSTRACT: One of the biggest challenges in robotics is to design and build robots that mimic human behaviour very closely and are physically similar with humans. Biped walking is one of the most complex movements of a human body and the main form of animal locomotion on land. It is defined as being the movement of a foot in front of the other with at least one foot on the ground at any time. The challenges of researching methods for implementing bipedal motion is the theme of this paper where we discuss about general robot characteristics, components used in this research, the way they were used, the different methods researched, with their advantages and disadvantages, the control of mechanical and electronic parts, all leading to obtaining bipedal walking.

1. COMPUTER AIDED DESIGN
The conception process is considered as an activity based on induction, deduction, intuition, experience and creativity. Through information technology systems, we can progressively transfer the experience, deduction and induction from the conception engineer to the CAD system, thus the latter becoming an intelligent system.
A CAD system requires a permanent dialogue, between the technical data basis and the general data basis on one side and the algorithms basis on the other side, through a conception monitor. Taking into consideration that the conception process has to offer optimal solutions to the problem, there is no general methodology, which can guarantee the global optimization of the conception. That is why CAD system has to allow the user to make a product with cost and time reduction and also with a high degree of flexibility. CATIA comes in aid of the users with structure editing facilities, inspection, cinematic simulations, databases, modules and possibilities of definition, storing and reusing of engineering knowledge.
CATIA offers an unique technological environment of design and preparation for manufacturing using the PLM concept (Product Lifecycle Management).
The premises on creating a parts of the robot in the CAD module are:
- its integration in the integrated system of production
- connection with the other two modules through: informational system, the definition of the types of information used and the compatibility of information
- the possibility of recognition of geometrical data (the geometric attributes of the product) by the CAPP module (the module which uses the data from CAD as in-data). Punctual attempts have shown particular interest on form features in the preparation for manufacturing stage. Instead of using a complex product starting from conception, at the end of this stage form characteristics extraction algorithms can be applied to the supplied model. With the help of calculated data this model can be expanded so it would come closer to a complex product, to a high level structure, containing not only the structural description of the piece but also complementary data regarding certain areas, profitable especially for manufacturing.

2. INTRODUCTION
Biped stands for “two feet” and comes from Latin bi for “two” and ped for “foot”. An animal or a machine that usually moves by means of two rear limbs or legs is called a biped.

Types of bipedal movement include: walking, running and hopping, usually on two legs. Although a robot with wheels has the ability to move faster, is less costly and less complex that a biped robot, the ability of walking represents the minimum condition for the robot as to be considered a partner rather than a machine. Furthermore, the bipedal movement has the following advantages: the ability to travel on uneven terrain, the ability to see a larger perspective due to its height, the ability to use its legs for purposes other than walking (e.g. kick a ball, engage a paddle) and the ability to use the upper limbs for other types of operations (e.g. opening doors and drawers, pushing buttons). Besides these advantages, there are several disadvantages such as: elevated center of mass, limited footprint and more complex control logic; all of the above reducing stability and increasing difficulty of maintaining balance.
The following states of movement associated with bipedalism are defined as follows:
Standing: is the state in which both legs stay still. This is an active process due to a constant adjustment of the balance.
Walking: is the state in which one foot is in front of the other, with at least one foot on the ground at any time.
Running: is the state in which one foot is in front of the other with periods where both feet are off the ground.
Jumping / hopping are the state of moving by series of jumps with both feet moving together.
Scientists who studied walking and running describe it as a repeatedly interrupted fall. An easy way to understand this concept is to observe the case when a person, in walking or running motion, advances one leg in front of the other to prevent itself from falling. This, along with maintaining balance, is what’s allowing the biped to advance. This is what is being discussed in the next chapters of this paper.

3. RESEARCH SETUP
The first step towards designing a biped robot is defining its functionality.
It is well known that the more degrees of freedom a robot has, the more its movement becomes more fluid and closer mimics its human counterpart; but at the same time the complexity of the mechanical, electronic and logical parts increases. Therefore, for the scope of this paper, we are setting out to achieve the basic functionality of walking from point A to point B.
3.1. Components
The components making up the robot were chosen with the following considerations in mind: functionality, size, weight, speed, cost, as well as resource availability and machinability. For structure we used aluminum plates and angles, hardware (screws, nuts and washers) of different sizes (Figure 2).

For the mechanical parts we used joint-type servomotors (Figure 3) with gear ratios suitable for the desired speed and weight of the robot. A servomotor is a small device that has an output shaft and a built-in control circuitry. The shaft can be set to a specific angular position by sending encoded signal to the servo. As long as the signal exists on the input line, the servo will maintain the angular position of the shaft. As the coded signal changes, the angular position of the shaft changes as well.

The control circuit board (Figure 4) allowed us to control up the eight (8) servomotors using a serial interface.

4. MOVEMENT RESEARCH
We started by studying human motions and determined that, for basic walking, we need approximately five degrees of freedom for each leg: two (2) degrees of freedom for the hip, one (1) for the knee and two (2) for the ankle. As already mentioned before, with more degrees of freedom we can achieve a more fluid movement but with a high complexity and cost this is not always practical. For the purpose of this paper we research the easiest method / setup to accomplish the required functionality – walking. The following sub-chapters describe the three methods researched and outline their advantages, disadvantages and conclusions.

4.1. Method I: Two Degrees of Freedom
This is the simplest configuration with one degree of freedom at the hip and one at the knee (zero at the ankle).

Advantages:
- Reduced number of servomotors.
- Reduced weight due to the small number of servos and other structural components.
- Low center of mass hence increased stability.
- Reduced cost.

Disadvantages: Although the advantages are enticing, the desired robot functionality cannot be achieved in this configuration due to the following reasons:
- Advancing one leg leads to rotation of the entire assembly in the OZ axis.
- Studying the human movement we realized that when we advanced one of the legs, the body repositions its center of mass above the supporting leg – the one that remains on the ground; this is not possible to replicate in this configuration of the robot because none of the servos work in the OX axis (left – right).

Conclusion: Two degrees of freedom are not enough for the robot to balance its center of mass from one leg to another and therefore to initiate walking.

4.2. Method II: Four Degrees of Freedom
After concluding that the first method was not enough to achieve bipedal walking we reconsidered the initial hypothesis of the five degrees of freedom we observed in human walking. However, we have noticed that one of the degrees of freedom at the ankle was not obviously used, therefore we decided to use four degrees of freedom for this configuration: two at the hip, one at the knee and only one at the ankle, as illustrated by Figure 6.
Advantages:
- Closer similarity to the human’s degrees of freedom.
- Ability for the robot to balance on one foot or the other - a requirement for initiating walking.

Disadvantages:
- Reduced stability due to its height.
- High center of mass.
- High vibrations and increased strain on the servomotors in maintaining necessary positions, due to increased weight and torque requirement.
- Higher program complexity.
- Higher number of components.
- Higher power requirements and high costs.

Conclusion: Although this method is close to being ideal, the chosen servomotor configuration did not produce the expected results, one of the reasons being the reduced power of the servomotors as well the complexity of maintaining balance.

4.3. Method III: Three Degrees of Freedom

After researching the two methods presented above, we realized that reducing to three degrees of freedom will enable us to reduce the height and weight of the assembly, achieving increased stability and simplify the control of balance from one leg to the other. This method consists of three degrees of freedom, one at the ankle, one at the knee and only one at the hip (dropping the second one over the previous method) as illustrated in Figure 7.

Advantages:
- Using three degrees of freedom allows for balancing weight from one leg to the other.
- Increased stability of the whole assembly due to its reduced height. In this configuration the robot can maintain vertical position with only one foot on the ground.
- Smaller number of components and lower cost.

Disadvantages: Although this method allowed us to accomplish the desired functionality, it is not the ideal one. In order to achieve better, more fluid motion, closer to human’s walk, the number of degrees of freedom must be higher. For that purpose we recommend using, in addition to servomotors, other mechanical devices such as: actuators, pulleys and linkages.

Conclusion: While not ideal, this is the method that successfully accomplished the basic functionality of the biped robot - walking (as described in the next chapter).

5. WALKING

The six servomotors we used allowed us to accomplish the required movement by controlling each motor at a given time through a command program.

The command program’s concept and terminologies are presented as follows:

Advantages:
- Using three degrees of freedom allows for balancing weight from one leg to the other.
- Increased stability of the whole assembly due to its reduced height. In this configuration the robot can maintain vertical position with only one foot on the ground.
- Smaller number of components and lower cost.

Disadvantages: Although this method allowed us to accomplish the desired functionality, it is not the ideal one. In order to achieve better, more fluid motion, closer to human’s walk, the number of degrees of freedom must be higher. For that purpose we recommend using, in addition to servomotors, other mechanical devices such as: actuators, pulleys and linkages.

Conclusion: While not ideal, this is the method that successfully accomplished the basic functionality of the biped robot - walking (as described in the next chapter).

5.1. Neutral Position

The position in which the robot stands vertically is called the neutral position. This is the initial position before the first step. Servomotors’ 180 degree rotational range is represented by commands on 7 bits in a 0 to 127 range or on 8 bits in a 0 to 255 range. We observed that the 90 degree position is not the same on all of the servomotors used in this research; therefore we set up a neutral position for each and every motor separately. All the other angular positions are relative to this neutral one. The neutral position for the six servomotors used is: 55, 60, 60, 55, 55, and 60 represented on 7 bits. A graphical representation of the neutral position of a servomotor is presented in Figure 9.
5.2. Walking Stages
The walking stages for this particular biped robot are presented in both front and side views as follows:

- **Stage 1:** The robot is in standing position. At this stage all servomotors are at neutral position (90 degrees).
- **Stage 2:** The center of mass is shifted over to the right leg (made of SM4 through SM6) by positioning SM1 and SM4 to the relative position of +10. The left leg will be automatically lifted off the ground.
- **Stage 3:** At this stage the center of mass remains over the right leg and the left leg is advanced forward by setting SM5 and SM6 to the relative position -20 and +20. Now the left leg is off the ground and advanced in front of the other.
- **Stage 4:** At this stage the center of mass is shifting over to the left leg by setting SM1 and SM4 to relative position -10. By moving the center of mass form the right leg (back) over to the left leg (front) the robot is advancing. Now the right leg is the one that comes off the ground. This will allow for making the next step.
- **Stage 5:** Is the mirror image of stage 3. At this stage we set SM2 and SM3 to relative position -20 and +20 and SM5 and SM6 to neutral position. Now the right leg advances in front of the left leg.

Next we go back to stage 1 and repeat the sequence to achieve continuous walking.

5.3. Flow Diagram
The diagram in figure 11 outlines the software functions that control the robot hardware for executing the commands described above.

As shown, there is a distinct separation between the part that handles the upper level command logic and the part that handles the lower level communication with the hardware. The two parts were designed to execute in parallel so that commands reach the servo controller hardware with minimum delay. The program starts by reading each of the steps declared in the program user interface (see figure 8 - Command Program Window), one step (column) at a time. Next, the program reads commands for individual servos for this step by advancing down the rows of the current column. For each value read, it encodes the command into a byte array and posts it to the command queue to be picked up by the lower level hardware controller component. Then, it immediately goes and reads the next one until there are no more servo values to process. This approach was sufficient for the purpose of this paper, however, for more precise applications, a feedback loop needs to be established in order to know when each servomotor is done executing the current command. The following diagram, and therefore the operation of the program, can easily be changed to accommodate this change by replacing the finite wait with a feedback loop.

6. CONCLUSIONS AND INTENTIONS
In this paper we discussed about the main functionality of a biped robot – walking. By observing the human motions, we started researching the methods by which to be able to mimic it closely. Each attempt has had its advantages and disadvantages and eventually we settled somewhere in between, with a solution that allowed both fluid movement as well as presented good stability and was relatively easy to control.

7. REFERENCES
VISUAL PROGRAMMING IN GAS ENGINEERING EDUCATION

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ABSTRACT: This paper presents the design of virtual instruments in natural gas engineering domain using modern methods of education. Virtual Instruments are created with the help of Labview software using classic structures of programming transposed into visual area. The instruments will calculate variables that appear in hydrodynamic investigations of natural gas wells. Also, in this paper we present a tutorial about LabView, that is very useful to learn fundamentals of LabView programming.

1. INTRODUCTION
Today, system architectures for sensor, signal processing, communications, and image processing applications consist of multicore desktop computers integrated with a variety of embedded networked devices. Each of these devices contains a set of sensors, microcontrollers, digital signal processors, and field-programmable gate arrays. NI LabVIEW graphical system design software is an inherently parallel, multicore system development platform specifically aimed at helping domain experts quickly design, prototype, and deploy large-scale complex applications and systems while significantly reducing development. G is a graphical programming language designed for engineers and scientists to develop test, control, and measurement applications. The intuitive nature of LabVIEW graphical programming makes it easy for educators and researchers to incorporate the software in a range of courses and applications. With LabVIEW, educators and researchers can use a graphical system design approach to design, prototype, and deploy embedded systems. It combines the power of graphical programming with hardware to dramatically simplify and accelerate the development of designs.

2. LABVIEW G VISUAL PROGRAMMING LANGUAGE
NI LabVIEW, a software based on the G programming language, is ideal for creating flexible and scalable design, measurement, control, and test applications rapidly and at minimal cost. Because of this, scientists can use it to interface with real-world signals, analyze and visualize data, and develop and prototype new algorithms. They and the students can make interface with external scientific computing libraries and text-based programming languages and scripts. But G is not the typical text-based programming language when combined with LabVIEW. LabVIEW G is a graphical programming language based on the dataflow model of execution.

Figure 1. Data flow programming concept
The basic concept of dataflow programming is that each node is enabled (executes) as soon as data is available at all of the node's inputs. This intrinsic architecture of LabVIEW and its G programming language is important for scientific computing applications because it allows nonprogrammers and domain experts to develop sophisticated, math-intensive applications that take advantage of parallel programming and parallel hardware. LabVIEW G is an ideal development language for targeting multiprocessor, hyperthreaded, and multicore systems, all of which are common in the scientific computing environment. The LabVIEW G language is different from commercial C or Java programming languages, because it uses pictorial form to create lines of code. It is not an text-based language such C or Java. This pictorial form called a block diagram, eliminate a lot of the syntactical details. With this method, you can concentrate on the flow of data within your application. Because their appearance and operation imitate virtual instruments, LabVIEW programs are called virtual instruments (VIs) However, behind the scenes they are analogous to main programs, functions, and subroutines from popular programming languages like C or Visual Basic. A VI program has two main parts:

- The front panel is the interactive user interface of a VI, so named because it simulates the front panel of a physical instrument. The front panel can contain can contain many controls (which are user inputs) and indicators (which are program outputs) like: knobs, push buttons, graphs, and many other;
- The block diagram is the VI's source code, constructed in LabVIEW's graphical programming language, G. The block diagram is the actual executable program. The components of a block diagram are: built-in functions, constants, and program execution control structures. You draw wires to connect the appropriate objects together to indicate the flow of data between them. Front panel objects have corresponding terminals on the block diagram so that data can pass from the user to the program and back to the user.

A VI that is used within another VI is called a subVI and is analogous to a subroutine. The subVI use in the block diagram, it must have an icon and a connector. The icon is a VI's pictorial representation and is used as an object in the block diagram of another VI. A VI's connector is the mechanism used to wire data into the VI from other block diagrams when the VI is used as a subVI. Much like parameters of a subroutine, the connector defines the inputs and outputs of the VI. Virtual instruments are hierarchical and modular. You can use them as top-level programs or subprograms. With this architecture, LabVIEW promotes the concept of modular programming. First, you divide an application into a series of simple subtasks. Next, you build a VI to accomplish each subtask and then...
combine those VIs on a top-level block diagram to complete the larger task.

3. LABVIEW G LANGUAGE IN GAS ENGINEERING EDUCATION

This paper will present how the language can be used for G devices to virtual engineering specific gas. It is an illustration of the way in which starting from a basic discipline training gas engineer in "The Engineering deposits of natural gas", using a discipline focused on the data acquisition devices, can be a virtual used as useful in production and research. Using the basic notions concerning the investigation of hydrodynamic gas probes, we present a case in which the application can use the virtual apparatus. Revaluation of physical parameters of current deposit is possible by conducting gas hydrodynamic research through located gas probes on gas structures. Conclusions to come off after research schemes allow resizing technology of extraction and assessment of future behavior deposit, factor in determining its performance. Hydrodynamic research methods in general are diverse and are divided into two categories depending on the movement of hydrocarbons in the porous permeable. There are such studies of productive formations in stationary regime of movement respectively nonstationary regime of motion. Considering the theoretical notions on "Investigation of productive formations in the stationary gas filtration" presented in [1] it was realized a virtual device that measures:

- The pressure of formation for various values of the radius between the radius of the probe radius and contour;
- Speed of filtrate for various values of the radius between the radius of the probe radius and contour;
- Flow volume of gas filtered pressure values calculated above

From a theoretical distribution of pressure on the direction of the probe shape is the food \( p^2 = f(r) \). Relationship is covered:

\[
p^2 = p_d^2 + p_{ct}^2 - p_d^2 \ln \frac{r}{r_s}
\]

Determining the speed of the filtrate is made using Darcy’s equation written in the form:

\[
v = \frac{k \cdot dp}{\mu \cdot dr}
\]

The hydrodynamic speed of the filtrate is the expression:

\[
v = \frac{k \cdot p_{ct}^2 - p_d^2}{\mu} \ln \frac{r_{ct}}{r_s} \cdot \frac{1}{r^2} \cdot p
\]

Determination of flow volume of fluid (gas) in permeable porous layer is made starting from the relationship:

\[Q = v \cdot A_c \]

where \( A_c = 2\pi r h \) life and represents the flow of gas through the porous.

Relationship to the flow volume of fluid is:

\[
Q = \pi k h \left( p_{ct}^2 - p_d^2 \right) \mu p \ln \frac{r_{ct}}{r_s}
\]

The panel is presented in Figure 2. Values for range are introduced by the user in control of type numeric. The numerical values are calculated in numerical indicators. The graphical representation allows the formation of pressure depending on the radius and velocity of the filtrate according to the radius.

Using language G is exemplified in the application diagram. This is represented in Figure 3 and ensure application operation. To achieve chart were used functions required to calculate the corresponding expressions of formation pressure, rate of flow and filtrate volume. They also used elements corresponding fundamental programming structures and graphical objects which allow the virtual graphic representation of the formation pressure and velocity of the filtrate according to the radius.
Another example is the virtual device that represents the graph obtained from an isochronous testing probes function of time. In panel application (Figure 4) is the table of variation of static and dynamic pressures and time when they were obtained. Diagram virtual device is represented in Figure 5.
4. THE TUTORIAL FOR LEARNING THE BASES OF LABVIEW G PROGRAMMING LANGUAGE

To ease the learning of programming in the language G has been designed as a Web tutorial that uses multimedia elements for examples notions. The tutorial contains 17 lessons: About Labview, Windows, Build VI, Data Type, SubVI, Debug, While Loop, For Loop, Array, Clusters, Case Structure, Sequence structure, String, Files, Build an Application.

Each lesson is based on a text and pictures in which he illustrated. Tutorial begins with an introduction that explains the context in which it was achieved (figure 6). “LabVIEW is a tool by National Instruments company. It is an integrated development environment (with graphic interface), based on G language. It is different than other development environments - programming in LabVIEW is based on conception of connecting icons. When using LabVIEW there is no need to write any source code, but only made graphic representation of program - using icons. Connected icons make diagram representing data flow - from source of information - to the end. As a source of information we can get external device or data input but user (on a diagram it is represented by appropriate icon). Analogous situation is about output. Data already processed can be passed to external device, or can be displayed on the PC monitor. This easy cooperation between LabVIEW and external devices - let the user treat computer as an supervising and controlling device. LabVIEW is often used in research centres”. The tutorial contains 17 lessons: About Labview, Windows, Build VI, Data Type, SubVI, Debug, While Loop, For Loop, Array, Clusters, Case Structure, Sequence structure, String, Files, Build an Application.

Many times there is a need to pass the value calculated in specific iteration (n) to the next iteration (n+1) of a loop. It can be done by using shift registers. To add shift registers to the loop (for lub while) you can right-click on the left border of loop, and select Add Shift Register. In first iteration Shift Register is fed with Initial Value. In next iteration this register will be holding calculated value from previous iterations. After running this example on the screen next values will be displayed 0, 3, 6, 9, 11, ... 27. Algorithm of work is simple. In first step register (from the left side) keeps (Initial Value). Into that is added value 3 and it is passed to the register on the right side. In next steps content of the left-hand side register is supplied with previously received result (save in right-hand side register).
The lesson about Case Structure is intended to introduce you to better control of program flow. Case structure lets choosing action depending on a value. Example below shows how does case work. Case condition will be valid for values of 0, 1 and 2. In all of those cases different statement will be displayed. To put structure case we should choose from Functions Palette Exec Ctrl > Case Structure. Case works accordingly to a chosen algorithm (by value). This choice depends on value that controls case structure. In case structure we will get statements: 0, 1, 2.

5. CONCLUSIONS

The paper shows how that can be used in visual programming of an educational process engineer in the gas. Are presented two examples of virtual devices with G code language, with the two flow charts of information which make them functional. In the last part of the paper presents an example of possible tutorial divided in 15 lessons needed to learn visual programming bases in G language. This tutorial allows the optimization of business development with 30%.

6. REFERENCES

EDUCATIONAL SPREADSHEETS FOR MASTER STUDENTS IN MANAGEMENT AND BUSINESS ADMINISTRATION

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ABSTRACT: At present, teaching computers for adult users, specialists in different fields of activity, is one of the most provocative pedagogical works because of the variety of the necessities and the lack of tradition in this kind of training. The paper aims at pointing on some of the most important aspects of teaching computers for the students, graduates and master students of economy faculties. A short overview of the decision making applications is presented. As part of the master course curricula, the paper presents the theoretical and practical issues of solving typical management problems by using the advanced functions of a spreadsheet software. The two examples – educational case studies with spreadsheet implementation, prove the utility of studying and applying the advanced facilities of general purpose spreadsheet programs for assisting the decision making process in business administration.

1. INTRODUCTION
Because of the great variety of the category of students and of the "high speed" computer science develops with, in the nowadays computer training, the teachers' experience and pedagogical ability is much more important than in other activities. On the one hand, the teacher has to learn himself in parallel with the educational process. On the other hand, inside of certain limits, he has always to perform a personalized training by dosing the new knowledge in such a manner as it can be the most efficiently accumulated by the students of that very moment. In this context, educational software based on case studies, is one of the most useful tools for teaching at all levels: undergraduate, graduate or master courses.

2. TEACHING COMPUTER FOR ADULT USERS
At present, the computer users can be more or less clearly divided into two categories: the users and the programmer. The former are common people of different specialties, having the necessity of using computers in everyday work; they are the "consumers" of informatics. The latter are people with a solid educational background in computer science creating themselves new programs and applications adequate to solve a specific problem of a specific field of activity; the result of their work is then applied by the users in order to perform their activity.

Teaching computer for users - specialists in different fields, reveals specific tasks that teachers have to solve in order their activity be efficient. From a more than 15 years experience in computers, both in programming and in training on PCs, result the following categories of people to be taught at different levels (the case of children and undergraduate pupils is presented elsewhere):

- Medium or highly qualified employed personal which has to learn in order to perform their work in new technical conditions. They need usually a basics course, followed by a training suitable to make them using the special software they need to work with. The duration of this kind of courses is 20 – 60 hours. Experience shows that almost everyone can reach a certain level, no matter the age, the education or the native intelligence.
- Managers and other people in leading position who wants to learn in order to "grow with the time", to use the computer in decisional activity and for having a better view of the activity in their department. The main problem of this category is the time factor: they are not able to take part at a regular course, no matter how concentrated, preferring a personalized training with flexible timetable, which can be carried out on their own computer, either at their office or at home. This kind of training cost more but is very efficient because is based on a personal relationship between the teacher and the student. The minimum result of such training is that the manager will be able to analyze more consciously the informational system of the firm, being more receptive to the requests of his system manager, programming engineer or other computer specialists.
- People who want to learn in order to obtain a new job. This category needs a general training which consists of a general basic course on hardware and software, learning to use a text editor, a spreadsheet application, a database managing application and followed (if needed) by the basis of a programming language. Usually this training is organized in several modules of 20-60 hours, giving a solid basic knowledge. At present, this is the most common form of computer training for people who hadn't the opportunity to learn computers in school. The success depends on the skills of the teacher and mostly on the homogeneity of the group.
- People who want to learn the use of a specific software. After learning the basis of computers, many people want to be able to use in optimal condition certain software. Most requirements are in the field of designing and accounting. According to this, the trainer has to have solid knowledge in general engineering on in economy. The students, usually, have to pass a short test consisting in basic knowledge on the computers and more detailed knowledge in the field of activity where the taught software is used.
- Students at universities of different specialties. Among them, the students of engineering faculties represent a special category because, in the "technical" field of activity, the computers entered in a relative easy way. Having a rigorous
"way of thinking" and a general technical training, engineers were able to use computers even in the "prehistorical" times, when only a command prompt was available on the screen. The graphic interface allowed more and more engineer to handle the computer; they use both designing programs and data processing software. For students in economics, the training consists in learning how to use a general accounting software and how to process data by the means of a spreadsheet program and a database manager. One of the taught software is usually the most widespread accounting program used in the specific geographical area. The master students in economics are supposed to have a solid knowledge basis in their field and good skills in using computers. The goal of their training within non-informatic master courses is to make them familiar with some tools they can use in their activity.

3. TEACHING DECISION MAKING METHODS

Making decision, at a higher or lower level, is a common task in almost all fields of activity. Master courses in economics usually include a course of computer assisted decision making. The main chapters of such a course refer to:

- Information systems for assisting decision in organisations
- Information and computer systems in organisations
- Data and information for decision making
- Computer systems for assisted decision making
- Modelling by using a spreadsheet program
- Modelling decision by using financial functions
- Optimising decisions by "What if…" type analysis
- Goal seeking
- Managing scenarios
- Optimising decisions by using "Solver"
- Modelling in project management
- Analysing and optimising by Critical path
- Project managing by Gantt charts
- Cost analysis
- Techniques for decision making in different conditions:
  - Certainty.
  - Uncertainty: maximax, maximin, Savage, Hurwicz, Bayes-Laplace methods
  - Risks: expectancy value, maximum probability method
  - Multi attribute decision making problems
  - Without preferences on the alternatives or attributes: dominance, maximin, maximax
  - Preferences on the attributes: conjunctive, disjunctive method, SAW, ELECTRE, TOPSIS, hierarchical trade-offs
- Using fuzzy sets

For most of the presented decision making methods, during the course the existence of specialised software is mentioned. This kind of software implements the mathematical model of the method, being a useful tool for the decision makers.

As practical issues, master students are asked to make their own “automations”, based on the presented algorithms and using general purpose software. The automation can be made at different levels: students build-up their original spreadsheets for implementing some low complexity models or they use ready-made programs that serve to better understand the steps of implementing a model. During the master courses for students in economics, we use MS-Excel spreadsheets for “What if…” analysis, linear programming, building-up scenarios, solving models for decision making in uncertain conditions or for building-up multicriterial sequential models.

We use MS-Access programs to follow-up the steps of solving different types of multicriterial models.

4. USING SPREADSHEETS FOR MODELLING DECISION METHODS IN UNCERTAIN CONDITIONS

The decision is the action course or the modality chosen by the decision maker from a set of alternatives, based on a set of criteria, in order to fulfilling one or more goals. Nowadays managers develop their activity in complex and permanently changing ambient that have important influences on the decision by: the quantity of the available information, the organisational goals, the personality and the value system of the manager and other internal or external conditions.

4.1. Elements of the decisional process

The decision is the result of a sequential process, including information, analysis and debate. The main elements of a decisional process are:

- The decision maker – the person or group that is in charge to take a decision.
- The action courses or alternatives – the possible strategies or options available for solving the problem. These consist of a finite or infinite number of independent variables \( A_i (i = 1,m) \).
- The criteria \( C_j, (j=1,n) \) – the points of view the decision maker considers in order to evaluate the alternatives.
- The payments or results – the a\( _{ij} \) consequences or estimated gains if applying the chosen alternative.
- The natural conditions or possible events \( S_i, (i = 1,k) \) – the sum of the external conditions, out of the will and control of the decision maker, that can generate different results for each criterion and each chosen alternative. Usually, the natural conditions are the result of a hazard or a complex of forces acting in different directions. For a decisional process, a finite number of natural conditions are considered and for each of then only one event can occur at a time.
- The probability of the natural conditions – the chance that a natural condition occurs. For the case of decision making in uncertain conditions, the probability of occurring of a specific natural condition is unknown. Of course, \( \Sigma_{n} p = 1 \).

Decision making in uncertainty is the case when for each alternative, two or more different results can be obtained. The manager is aware of the different natural conditions influencing the result but he can’t estimate the probability of occurring of the events.

In the present, the theory offers different criteria for choosing one or another alternative in uncertain conditions. The most known criteria are:

- The optimistic criterion
- The pessimistic criterion
- The Savage criterion, based on the regrets
- The Hurwicz criterion, on realistic basis
- The Bayes-Laplace, equi-probabilistic criterion.

Each of the criteria has limits and recommendations. Applying one of them depends on the organisational policy and on the attitude of the manager towards the risk. Table 1 synthesises the recommendations and limits for each of the presented methods.

Decision making in uncertain conditions is much more difficult than in certainty or risk. Depending on the really occurring
conditions, the result of such a process can be disastrous. To avoid this, the recommendation is to try to gather more data in order to be able to use other, more secure methods.

4.2. Short description of the method

The elements of the decisional process can be synthesised in a decisional table named payments’ or gains’ table. For solving a problem with the above mentioned criteria, a spreadsheet table is built-up. According to the chosen criterion, common spreadsheet functions are used.

**Table 1. Decision making in uncertain conditions.**

<table>
<thead>
<tr>
<th>Method</th>
<th>Advantage</th>
<th>Disadvantage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optimistic</td>
<td>Positive behaviour</td>
<td>High level of risk assumed</td>
</tr>
<tr>
<td>Pessimistic</td>
<td>Lowest level of risk assumed</td>
<td>Excludes the possibility of very high gains</td>
</tr>
<tr>
<td>Regrets</td>
<td>Guarantees the maximum level of regrets</td>
<td>Excludes the possibility of very high gains</td>
</tr>
<tr>
<td>Hurwicz</td>
<td>More realistic</td>
<td>There is no method for establishing the “level of optimism”</td>
</tr>
<tr>
<td>Bayes-Laplace</td>
<td>Good if very few information is available</td>
<td>There is no theoretic or experimental support to consider equi-probability</td>
</tr>
</tbody>
</table>

The **optimistic** criterion supposes the optimistic behaviour of the decision maker: he will choose the alternative that in optimal natural conditions assures the best result. The MAX function will be used for “best gain” type problems and the MIN function will be used for the “minimum loss” type problems.

The **pessimistic** criterion supposes a pessimistic behaviour of the decision maker: he will choose the alternative that in the worse natural conditions assures the best results. Depending on the problem, a combination of MIN and MAX functions will be used.

The **Savage** criterion is based on minimizing the regrets. In this context, regret means “loosing the opportunity” or “cost of chance”: the decision maker evaluates the difference between the result corresponding to each alternative in specific conditions and the best obtainable result that corresponds to the optimal natural conditions. He will choose the alternative leading to minimum regrets in any natural conditions. A combination between arithmetic operation and MIN – MAX functions is used.

The **Hurwicz** criterion is based on more realistic thinking while it’s a compromise between the optimistic and pessimistic criteria. The decision maker defines his “level of optimism” as a number between 0 and 1, where 1 means totally optimistic and 0 means totally pessimistic. He will choose the alternative that assures the best result while the probability of occurring for the natural conditions is balanced by his level of optimism. Arithmetic operation and MIN – MAX functions are used.

The **Bayes-Laplace** criterion supposes equal probabilities for the occurring of each natural condition. The decision maker chooses the alternative that gives the best result for this assumption. Arithmetic operations and basic spreadsheet functions are used.

4.3. Using a didactical spreadsheet

Students can easily understand the methods if they solve a case study. In order to focus more on the problem and less on the implementation, they are given a file with one prepared sheet for each method. The sheet contains the main mathematical formula of the model and a table to be filled-in with data. The functions used for each method are very easy to apply, so we decided to ask students to write their own formulas.

Let’s have the following **case study**: an organisation that produces fridges intends to introduce a new, ecological product. The planning department identifies the following three alternatives for the new production line:

- A1 – to extend the existing factory with a new line;
- A2 – to build a new factory, with new technology;
- A3 – to subcontract production to other firms.

The identified natural conditions related to the demand on the market are:

- S1 – high demand, due to the success of the new product;
- S2 – moderate demand, due to a moderate rate of acceptance for the new product;
- S3 – low demand on the market;
- S4 – a total failure, due to the refuse of the new product on the market.

According to the production size in the four possible natural conditions, the cost calculation for each alternative leads to the incomes presented in Table 2. The values are in Romanian currency. The negative numbers mean losses.

**Table 2. The gains’ table – incomes for the decisional problem.**

<table>
<thead>
<tr>
<th></th>
<th>High demand</th>
<th>Moderate demand</th>
<th>Low demand</th>
<th>Failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>To extend</td>
<td>50.000</td>
<td>25.000</td>
<td>15.000</td>
<td>-35.000</td>
</tr>
<tr>
<td>To build</td>
<td>70.000</td>
<td>30.000</td>
<td>10.000</td>
<td>-50.000</td>
</tr>
<tr>
<td>To subcontract</td>
<td>30.000</td>
<td>15.000</td>
<td>7.000</td>
<td>-10.000</td>
</tr>
</tbody>
</table>

The decisional matrix in MS-Excel is a copy of table 2. The worksheet includes a set of gray cells to be filled-in with the formulas and functions corresponding to each model. There are also empty parts of the spreadsheet where students will build the model – assisted by the tutors.

Solving the problem by an optimistic decision maker is presented in figure 1. He will count on the best gains, no matter the risks. For implementing the choice – both for evaluating the result and for choosing the recommended alternative, MAX function will be used. For presenting the recommendation as text, IF and CONCATENATE functions are applied.
Figure 1. Solving the problem by a totally optimistic decision maker.

Solving the problem by a totally pessimistic decision maker is presented in figure 2. He will count on the worse natural conditions. Than, from the three bad results, he will choose the alternative that leads to the “less bad” gain. A combination of MIN and MAX function will be used. For improving the aspect, the recommendation is presented as a text.

Figure 2. Solving the problem by a totally pessimistic decision maker.

The spreadsheet demonstrating the Savage criterion is presented in figure 3. The first formulas evaluate the difference between the best possible result and the expected result in the specific natural conditions. Than, the minimum from the highest calculated regrets is chosen and the corresponding alternative is recommended.

Figure 3. Solving the problem by minimising the regrets.

Solving the problem with Hurwicz criterion leads to a more realistic result (figure 4). The decision maker is supposed to be 60% optimistic. The best result for the considered natural conditions is weighted by the “level of optimism”, while the worse result is weighted by the “level of pessimism”. The optimal decision corresponds to the best evaluated alternative.

Figure 4. Solving the problem by a realistic decision maker (Hurwicz criterion).

The spreadsheet demonstrating the Bayes-Laplace criterion is presented in figure 5. The coefficient of equi-probability is calculated on the basis of the number of the possible natural conditions. The expectancy value is the sum of the consequences weighted by the coefficient of equi-probability.
The Electre method is a multi-criterial decision making method which helps the decision making process by taking in account not only the quantitative elements but the qualitative (subjective) elements of the studied phenomenon. The aim of the method is to compare projects, solutions, plans, strategies, actions, etc. in order to help the concertation of different parties, with different opinions. The qualitative elements, like "good", "quite attractive", "very fast" give to input data a character of imprecision and non-determination. The method considers the preferences and convictions of the participants to the decisional process and leads to an optimal solution based on a mathematical model, without pretending to find the best scientific solution.

5.1. Short description of the Electre method

The Electre method is able to classify the different alternatives of a problem or a project from the best to the worst on the basis of criteria. This method does not perform a complete, but a partial aggregation of the criteria considered. It means that criteria are not all commensurable and cannot be reduced to a unique unit, monetary in general, to furnish this global value. Electre compares all the alternatives two by two according to criterion after criterion. When all criteria are reviewed, the concordance (C) and the discordance (D) matrix: the discordance condition whereby the bad scores are required to be above a specific threshold. The value of this threshold is not absolute and may be adjusted so as to investigate the stability of the ranking.

For a certain problem, the bi-dimensional “basic” Electre method gives often an uncertain or incoherent solution. Incoherence means that two or more alternatives are equally positioned in the top of preferences. The explanation of such results is the mathematical method for computing the discordance (D) matrix: the discordance is evaluated using only the weights while the discordance take in account only the maximum difference between the utilities for a certain criteria. By improving the basic model, in most cases the incoherence can be eliminated and the solution becomes a clearly ordered top of preferences.

5.2. Facilities of the didactical Electre software

The Electre software is built-up in order to help the study of multi-criterial decision making models in the framework of management classes. The software gives the possibility to students to intimately study the Electre model by Step by Step data processing and viewing intermediate results. The input data and weight evaluation are performed by the user with permanent assistance. The intermediate and final results are stored on magnetic memory in order to be studied later or printed.

Being used by specialists and non-specialists as well, the program is provided with a user-friendly interface. Suggestive object names, clear messages and large comment lines are provided, in order to give a useful overview both on the method and on the programming process.

The starting screen, presented in figure 6, allows the user to view and solve again an existing example or to initialize a new problem. The main menu presented in figure 7 is used to view, modify or add data for a problem.
For initializing a new problem, the user has to introduce some basic data and the utility matrix. This matrix synthesises the opinion of the specialists regarding the influence of the factors (X) on the result of acting according to different alternatives.

Let’s consider the following new problem: a firm wants to import coconuts. There are four available alternatives (A): Am., Dole, Chile and Brazilian coconuts. The specialists are asked to evaluate the influence of five characteristics (X) on the possible profit of the firm: size, dry material, sweetness, colour and behaviour on transportation. The preliminary dialog screen is presented in figure 8 and the new set of starting data is presented in figure 9.

While introducing data, some validation is performed. For instance, the sum of the weights – as coefficients of importance for the factors, has to be 1. The appropriate messages are displayed, as presented in figure 10.

For didactic purpose, each step of the solving process can be launched individually: the utility matrix, building the concordance and discordance matrix, applying a method for eliminating incoherency and establishing the final ranking. The step by step menu is presented in figure 11. As an example, the concordance and discordance matrix for the considered problem is presented in figure 12.

The final result consists of a ranking of the alternatives. Solving the considered problem leads to the ranking presented in the left part of figure 13. The right part of the same figure presents a possible result for a more complex problem.

The basic model is permanently improved by adding new facilities both for the content and for didactic purpose.

6. REFERENCES

THE ERGONOMICS OF THE EDUCATIONAL VIRTUAL SPACE USED IN ENGINEERING

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ABSTRACT: In an educational virtual space/ environment, different people cooperate in order to achieve the objectives of an e-learning programme. The educational virtual space is a substitute of the traditional class, involving a real teacher and instructional materials used in the learning process. The learning process is a mental and complex process, which is still being deliberated. Ergonomics is the science that studies the impact of the environment over humans. In the virtual spaces designed for the learning process, there take place complex, difficult to control activities. So, ergonomics plays a major role in the rated capacity of the e-learning process. In this paper, the authors debate the problem of the educational virtual spaces’ ergonomics, especially in the field of the engineering sciences. Considering the ergonomic rules of working on the Internet, the authors discuss the aspects of the ergonomic criteria for designing educational sites, as well as the benefits of the ergonomic interfaces. They also present a prototype site developed to teach the discipline “Computer Graphics”.

1. INTRODUCTION

The term “ergonomics” was defined by the IEA (International Ergonomics Association) in 2000 as “the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimise human well-being and overall system performance.” [13]

Later, there was developed a series of standards, such as ISO 6385:2004, containing general design principles and methodologies, and standards referring to ergonomics of human-system interaction, such as ISO 9241-151:2008. The standard ISO 9241-151:2008 is focused on World Wide Web user interfaces. [14] The recommendations contained in this standard are concentrated on the design strategies, content design, navigation and search tools, and content presentations.

In the report [1], the author presents his researches related to the modality of users reading web pages. His researches prove that users do not read the entire text, they only skim through it. Also, he presents in [11] his experimental researches relative to the modality users read web pages. He studied the movement of the sight on the screen (eye-tracking study). The experiment consisted in analyzing the manner of 232 users looking at web pages. The conclusion was that the main pattern of the manner of web pages’ reading is an “F pattern”, whereas some other times users read according to an “E pattern” or an inverted “L pattern”. According to him, users read web pages according to their contents.

In a learning process, it is imperative to connect all principles of user interface design with the online instructional models and the content which has to be taught. The instructional model which was selected in the researches of this report is the model of information processing, that was developed by Atkinson&Shiffrin, Hintsch, Klatsky, Loftus&Loftus [1]. This model consists of three levels:

- Sensorial input and record;
- Short-term memory (STM has the limit of 7±2 items, the information is active for 15-20 seconds without being iterated);
- Long-term memory (LTM has an unlimited capacity and duration).

The goal of our researches is to establish some rules to design and construct web pages of an electronic course. Our research studies were unfolded within the framework of the Master Studies programme “Advanced Technologies to Information Processing”, during the second semester of the university year 2008-2009. The experiment consisted in designing and building online pedagogical resources, which were analyzed and discussed by teachers and students. Also, these online resources (30 web sites) were classified and there were drawn conclusions about the ergonomic aspect of the web pages. The obtained results are a set of principles and a prototype site dedicated to teach the discipline “Computer Graphics”. The goal of these studies consists in increasing the usability of the educational web pages in order to improve the online courses used in the university.

2. ERGONOMIC RULES ON THE EDUCATIONAL WEB PAGES

Buchholz stated in [2] the stimulus “When you write for the Internet, think ‘presentation’ and ‘interaction’”. Ergonomic rules on the educational Web Pages were formulated by Nielsen [1], [11], Buchholz in [2], and these rules were introduced to the students, at the beginning of the experiment.

Taking into consideration these recommendations, the students realized online pedagogical resources (special virtual laboratories from the computer science field), which were discussed and analyzed.

The recommendations which were respected and used are:

- The content has to be split in small pieces;
- The headlines and content labels are to be well distinguished;
- General information has to be placed at the top of pages;
Educational sites should offer to students the possibility to:
- skip certain units;
- Distinguish the modules already read;
- Support online communication via e-mail, chat, (synchronous and asynchronous communication);
- Offer the possibility to print or to save documents;
- Insert references and web resources with helpful summaries;
- Respect the display pattern (F, E and inverted L);
- Consider the target group (age, knowledge, professional education, etc.);
- Consider the instruction context (referred to as “social context”, “emotional context”, “mental context”, “school context”, “technological context”, “knowledge context” [9]);
- Limit the number of paragraphs on every web pages (taking into account the limit of STM);
- Offer to students the possibility to check the pedagogical path;
- Respect the same format on every page of the electronic course;
- Offer a search box;
- Offer a glossary of terms;
- Offer a plan of the site;
- The menu has to be placed at the top of the screen and the navigation bar - at the bottom of the screen;
- Educational sites should offer to students an orientation in the virtual space (the students have to know very well where they are in the online course and why they are in that space);
- The graphics has to be clear, located in the right space of the screen (taking the example presented in [9], the image is placed in the left side of the screen, therefore this is only a recommendation 3);
- Use short paragraphs;
- Place in a visible manner the Home button.

Related to formatting the text, it is necessary to respect the following recommendations:
- Use text written with dark letters;
- Use light background;
- Use 10-14 dots as dimension of font text;
- Use spacing between the lines of the paragraph;
- Don’t underscore the text, as this may lead to a confusion related to links to web pages;
- Check the visualization of the web pages of the online resources on different technologies (different displays, the screen of the video projector);
- Distinguish some words using colors unlike the colors of the body text;
- Use fonts with a great space between the letters (such as Verdana);
- Leave space between the paragraphs;
- Use titles, subtitles, headlines, labels.

In figures no. 1, 2 and 3, there are presented screens shots from the virtual laboratories situated at the top of the classification realized in the experimental researches.
be guided in the instructional process without feeling constrained.

3. PROTOTYPE OF THE “COMPUTER GRAPHICS” ONLINE COURSE

The prototype of an online course was developed in a manner resembling the creation of a film. Each web page of an online course represents a scene and each scene has to be planned and designed. In this experiment, there were stressed the ergonomic aspects of the educational web pages, namely the modality of organizing the information on the screen.

The steps considered in this process are:

1. assessing the students’ needs;
2. analyzing the content of the course;
3. dividing the information in small pieces and ordering it according to its importance, generality degree, type;
4. grouping the pieces of information according to their contents;
5. ordering the web pages of the online course;
6. analyzing the ergonomic aspect of every page of the course;
7. analyzing the functional aspect of the application;
8. establishing the navigational mode in the course;
9. outlining all web pages on the paper or on simple files;
10. building the prototype site of the course.

In figure no. 4, there is displayed an instance of the web page dedicated to the course entitled “Computer Graphics”.

The predominant elements in designing this course were: the format of the information (video, pictures, audio format) and the professional formation of the students: Engineering students are unlike Arts or Mathematics students. They are oriented to applications, they have to be comfortable in their virtual educational space, they have to find quickly what why they need.

Also, another aspect that was taken into account in designing the prototype was the user’s age. An observation is that usually young people are those who design and build electronic courses. In report [12], there may be found rules and instructions about designing web sites dedicated to the instructional process for adult learners. The authors stressed the features of the visual and technological components of the sites and specific needs for elder adults. Some considerations are related on the following aspects [12]:

- Layout and style;
- Scrolling;
- Color;
- Menus and navigation;
- Button and styles;
- Sitemap and search;
- Language and terminology;
- Multimedia
- User customization
- Documentation and feedback;

So, human factors are in the center of user interface. Developing online courses with high usability is conditioned by the human-centered interfaces. The activities that are realized to develop a human centered project are [3]:

- “plan the human centered process
- understand and specify the context of use
- specify user and organizational requirements
- produce design solutions
- evaluate design against requirements”

A final phase of the experimental researches was the prototype’s usability testing.

The usability of a product is the degree in which this product can be used by specific users to reach certain goals according to efficiency and satisfaction in a specified using context. [6]

The major objectives pursued in the usability testing of the prototype were selected according to Dix [5]:

- evaluation of the functionality of the system;
- evaluation of the interface’s impact on the users
- identification of the problems posed while using the system.

The scales used in evaluations were 0 to 4, gradual with the gravity of the pointed out problems [6]:

- “0. I do not consider this a problem of usability.
- 1 It is a “cosmetic” problem that is to be tackled only if there is any available time left while developing the project.
- 2. Minor problem of usability– tackling it is not considered a high priority.
- 3. Major problem of usability – its repair is a high priority.
- 4. A “catastrophe” for usability – it is imperative that the problem be solved before delivering the product. “

In figures no. 5 and 6 there are presented screen shots of the web sites prototype dedicated to teach and learn “Computer Graphics”. 

Figure 4. An instance of a web page

Generally speaking, it is known that many students prefer to highlight and annotate readings. Engineers make a lot of calculation (so, they need papers and pens) and they have to visualize 3D drawings. As a result, the virtual space has to comprise dedicated spaces for blank screens and 3D visualization of the images, giving the students the possibility to control the speed of films. That means that it is necessary to include Pause/Stop buttons.

Another consideration is the user screen customization. Many students from the engineer field change the appearance of the screen. They use different browsers and monitors (laptops or LCD or flat monitors). In this case, too much freedom and too many options are not recommended, as the students must be stay concentrated at the lesson.
Figure 5. Screen shots of the Computer Graphics site

Figure 6. Screen shots of the Computer Graphics site
4. CONCLUSIONS

The most important criteria used in evaluating the content for online learning process are: “user interface, usability, ergonomic aspects, design of the learning environment”. [8] In this paper, there are discussed the ergonomic rules in the web pages, stressing the web pages of an electronic course. Courses which are realized without any design of the web pages do not reach their goals. The learner groups have to be strongly motivated and this aspect implies aesthetic and comfortable educational environment. The content has to be clearly structured and displayed in an ergonomic mode.

5. REFERENCES


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SOFTWARE APLICATION FOR STRUCTURE EXAMINATION OF PLANE IRON BAR BEAM

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ABSTRACT: This paper presents the software for structure examination of plane iron bar beam, so that the students, has possibility to study the design methods and utility of the software for structural analysis. The students have the possibility to test the operation mode for software with finite element analysis. The structural system is analyzed using a geometrically linear elastic model of iron bar beam. The students will find in the paper information on application of finite element theory as well as on how it can be applied, for reality instance.

1. INTRODUCTION

The iron bar beam is a part of a structural system that consist of straight bars connected to each other by hinged joints, they are called truss. The length of truss being much longer that the width and height at the cross section. These may be compression or tension forces and has only axial deformation. The loads are applied only at bar’s joints. Trusses can be used for bridge engineering see figure 1.

![Figure 1. Bridge engineering](image1)

Because the forces in each of its two main girders are essentially planar, a truss is usually modeled as a two-dimensional plane frame.

The system of external loads is transferred by truss to the supports maintaining the equilibrium with the reactions of joint of body.

2. ABOUT FINITE ELEMENT METHOD

To apply the finite element method the structure is discretized into structural parts named finite elements. For the truss the finite element is the bars. The joints are the points where the finite elements are interconnected and each node is associated to nodal forces and nodal displacements.

Consider a bar of length L, a homogeneous isotropic material with modulus of elasticity E with a constant cross-sectional area A, which is subjected to a tensile force N. The stress σ at the cross-section is constant and is expressed by:

$$\sigma = \frac{N}{A} \quad (1)$$

![Figure 2. Elongation of bar](image2)

The elongation of bar expressed by:

$$\Delta L = \frac{N \cdot L}{E \cdot A} \quad (2)$$

The relation (2) can be written:

$$\frac{E \cdot A}{L} \cdot \Delta L = N \quad (3)$$

Where \( \frac{E \cdot A}{L} \) is the stiffness of bar.

For determinate the stiffness of truss we consider a truss member of length L that has the nods fixed. If move the nod i by \( u_i \) in the bar is give birth a axial force \( N_{ii} \), see figure 3a.

![Figure 3. Moving of nods i, j](image3a)

For equilibrium in the node j is give birth axial force \( N_{jj} \) figure 3a. If move the nod j by \( u_j \) in the bar is give birth an axial force \( N_{jj} \), see figure 3b. For equilibrium in the node i is give birth axial force \( N_{ij} \) figure 3b.
By using superposition of effects may be determinate the nodal forces expressed by:

\[ N_j = N_{xj} + N_{yj} \]

Substituting axial force relation (3) into equation (4) we get:

\[ N_j = \frac{E \cdot A}{L} \cdot u_i - \frac{E \cdot A}{L} \cdot u_j \]

\[ N_j = -\frac{E \cdot A}{L} \cdot u_i + \frac{E \cdot A}{L} \cdot u_j \]

Under matrix form equation (5) can be expressed as:

\[
\begin{bmatrix}
N_i \\
N_j
\end{bmatrix} = \begin{bmatrix}
\frac{E \cdot A}{L} & -\frac{E \cdot A}{L} \\
-\frac{E \cdot A}{L} & \frac{E \cdot A}{L}
\end{bmatrix} \begin{bmatrix}
u_i \\
u_j
\end{bmatrix}
\]

Or in a simplified form equation (6) becomes:

\[ \{N\} = [k] \cdot \{u\} \quad (7) \]

Comparing equation (3), with equation (6) and (7) we observe that the truss element stiffness matrix is given by:

\[ [k] = \frac{E \cdot A}{L} \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix} \quad (8) \]

Stiffness matrix (8) is report at inner coordinate axis which is attach to the bar, see figure 3. The longitudinal axis of the bar was along the element x-axis.

For an element arbitrarily oriented in global coordinate system, see figure 4 and figure 5, the x-axis of the element can be rotated in order to coincide with the X-axis of the global coordinate system.

For nodal forces we will be:

\[ \{N\} = [T] \cdot \{F\} \quad (13) \]

The matrix of directional cosines is an orthogonal matrix in this case its invert coincides with its transpose \([T]^{-1} = [T]^T\). By multiplying in equation (14) at the left with \([T]^T\) we will obtained:

\[ [F] = [T]^T \cdot [k] \cdot \{T\} \cdot \{\delta\} \quad (15) \]

Or in a simplified form:

\[ [F] = [k] \cdot \{\delta\} \quad (16) \]

Where \([k]\) is the element stiffness matrix expressed in the global coordinate system?

In final form element stiffness matrix is:
\[ [k] = \frac{E \cdot A}{L} \begin{bmatrix} 1^2 & 1 \cdot m & -1^2 & -1 \cdot m \\ 1 \cdot m & m^2 & -1 \cdot m & -m^2 \\ -1^2 & -1 \cdot m & 1^2 & 1 \cdot m \\ -1 \cdot m & -m^2 & 1 \cdot m & m^2 \end{bmatrix} \] (17)

The element stiffness matrix in the global coordinate system will be used to assemble the global stiffness matrix of the structure.

3. SOFTWARE APPLICATION

3.1. Input Data

Consider a plane truss that contains \( n_{el} \) truss elements and \( n_{nd} \) nodes. Each node has a horizontal and an vertical displacement that are common for elements connected to that node. In this case the total number of degrees of freedom for the truss is \( 2 \cdot n_{nd} \). We have a linear system of \( 2 \cdot n_{nd} \) equations with \( 2 \cdot n_{nd} \) unknowns.

Input data is for structure which is presented in figure 4.

- number of elements \( n_{el} = 7 \)
- number of nodes \( n_{nd} = 5 \)
- degrees of freedom per node \( gln = 2 \)

In the matrix \( c(n) \) first column contain the number of nod, second and respective third column x coordinate and y coordinate in global coordinate system. In matrix \( n \) is a numerical variable.

\[
c(n) = \begin{bmatrix} 1 & 0 & 0 \\ 2 & 1000 & 1500 \\ 3 & 2000 & 0 \\ 4 & 3000 & 1500 \\ 5 & 4000 & 0 \end{bmatrix} \] (18)

In the matrix \( el \) first column contain the number of element, second and respective third column number of nod i and number of nod j.

\[
el = \begin{bmatrix} 1 & 1 & 2 \\ 2 & 1 & 3 \\ 3 & 2 & 3 \\ 4 & 2 & 4 \\ 5 & 3 & 4 \\ 6 & 3 & 4 \\ 7 & 4 & 5 \end{bmatrix} \] (19)

In the matrix \( AE \) first column contain the number of element, second and respective third column cross section area in \([\text{mm}^2]\) and modulus of elasticity in \([\text{kN/mm}^2]\), for finite element.

\[
AE = \begin{bmatrix} 1 & 650 & 210 \\ 2 & 650 & 210 \\ 3 & 650 & 210 \\ 4 & 650 & 210 \\ 5 & 650 & 210 \\ 6 & 650 & 210 \\ 7 & 650 & 210 \end{bmatrix} \] (20)

In the matrix “\( F \)” first column contain the number of node where force is applied, second column contain projection of \( ox \) axis and respective third column projection of \( oy \) axis.

\[
F = \begin{bmatrix} 3 & 0 & -400 \\ 4 & 300 & 0 \end{bmatrix} \] (21)

In the matrix \( leg \) first column contain the number of node where degree of freedom is blocked. Zero value degree of freedom is not blocked and value one, degree of freedom is blocked.

\[
leg = \begin{bmatrix} 1 & 0 & 1 \\ 5 & 1 & 1 \end{bmatrix} \] (22)

3.2. Element Calculation

The length of element is:

\[
\text{Le} = \sqrt{c(n)_{(j,ne,2)} - c(n)_{(i,ne,2)}} + \sqrt{c(n)_{(j,ne,3)} - c(n)_{(i,ne,3)}} \] (23)

The directional cosines are:

\[
c(ne, n) = \frac{c(n)_{(j,ne,2)} - c(n)_{(i,ne,2)}}{\text{Le}(ne, n)} \] (24)

\[
s(ne, n) = \frac{c(n)_{(j,ne,3)} - c(n)_{(i,ne,3)}}{\text{Le}(ne, n)} \] (25)

The element stiffness matrix will be used for compute the stiffness matrix of structure.

The element stiffness matrix in global coordinate system is given by:

\[
C(ne, n) = c^2(ne, n) \] (26)

\[
S(ne, n) = s^2(ne, n) \] (27)

\[
\text{CS}(ne, n) = c(ne, n) \cdot s(ne, n) \] (28)

\[
\text{ke}(ne, n) = \frac{AE(ne, i) \cdot AE(ne, j)}{\text{Le}(ne, i)} \cdot \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix} \] (29)

It should be noted that calculation of the element stiffness matrices is not efficient and may be determined the stiffness global matrix in the global coordinate system.

The global stiffness matrix \( K \) can be formulated in the procedure shown below by using the node numbering and the stiffness matrix of elements.

\[
nmdep = n_{nd} \cdot gln \] (30)
The global stiffness matrix $K$ consist of $2 \times nnd$ rows and $2 \times nnd$ columns, each row and column corresponding to a specific degree of freedom of the structure.

The global stiffness matrix $K$ is singular in its full form and it can not be inverted.

Since rigid body displacement is not restrained in the system equation the global stiffness matrix is singular in its full form. Restrained boundary conditions, is performing by eliminating the rows and the columns that correspond to the fixed degree of freedom. In this case we obtain reduced stiffness matrix $K_r$ of structure.

The boundary conditions restrain the displacements at nodes nr. 1 and 5. At node 1 we will be $\delta_1x=0$ and $\delta_1y=0$, ant at node 5 we will be $\delta_5x=0$ and $\delta_5y=0$. Nodal displacements of node 1 and 5 correspond to the 1, 2, 9, 10 degree of freedom of structure.

In this case rows and columns 2, 9, 10 will be removed from stiffness matrix of structure.

The vector with fixed degree of freedom can be formulated in the procedure shown below:

\[
\text{db} := \begin{cases}
\text{nr_col} \leftarrow \text{cols(leg)} \\
\text{nr_rand} \leftarrow \text{rows(leg)} \\
s \leftarrow 0 \\
\text{for } i \in 1..\text{nr_rand} \\
\quad \text{for } j \in 2..\text{nr_col} \\
\quad \quad (\text{continue}) \text{ if } \text{leg}(i,j) = 0 \\
\quad \quad s \leftarrow s + 1 \\
\quad \quad \left[ a \leftarrow \text{leg}_{(i,1)} (gln - 1) \right] \text{ if } j = 2 \\
\quad \quad \left[ a \leftarrow \text{leg}_{(i,1)} (gln - j) \right] \text{ if } j = 3 \\
\quad \quad \text{db}_s \leftarrow a
\end{cases}
\]  

(32)

The global reduced stiffness matrix $K_r$ can be formulated in the procedure shown below:

\[
\text{Kr} := \begin{cases}
a \leftarrow \text{rows(dl)} \\
\text{for } i \in 1..a \\
\quad n \leftarrow \text{dl}_i \\
\quad \text{for } j \in 1..a \\
\quad \quad m \leftarrow \text{dl}_j \\
\quad \quad \text{Kr}(i,j) \leftarrow K(n,m)
\end{cases}
\]  

(34)

The reduced vector of active forces can be formulated in the procedure shown below:

\[
\text{Fr} := \begin{cases}
a \leftarrow \text{rows(dl)} \\
b \leftarrow 0 \\
\quad \text{for } i \in 1..a \\
\quad \quad \text{fr}_{i1} \leftarrow 0 \\
\quad \quad c \leftarrow 0 \\
\quad \quad \text{for } j \in 1..\text{rows(F)} \\
\quad \quad \quad a1 \leftarrow F_{(j,1)}^2 - 1 \\
\quad \quad \quad a2 \leftarrow F_{(j,1)}^2 \\
\quad \quad \quad \text{fr}_{1} \leftarrow F_{(j,2)} \text{ if } a1 = \text{dl}_{i1} \\
\quad \quad \quad \text{fr}_{1} \leftarrow F_{(j,3)} \text{ if } a2 = \text{dl}_{i1} \\
\quad \quad \quad c \leftarrow 0 \\
\quad \quad c \leftarrow 0
\end{cases}
\]  

(35)
The reduced system of equations is solved for nodal displacements $\mathbf{d}$.  

$$ \mathbf{d} = \mathbf{K}^{-1} \cdot \mathbf{F} \quad (36) $$

The total displacement vector can be formulated in the procedure shown below:

$$ \mathbf{d} \leftarrow \text{rows}(\mathbf{d}b) $$

for $i \in 1..\text{nnd} \cdot \text{gln}$

for $j \in 1..a$

if $\mathbf{d}b = j$

$$ \mathbf{d}p_j \leftarrow 0 $$

break

$c1 \leftarrow 0$

for $i \in 1..\text{nnd} \cdot \text{gln}$

for $j \in 1..b$

if $\mathbf{d}l = i$

$$ \mathbf{d}p_j \leftarrow \mathbf{d}p_j $$

break

$c1 \leftarrow 0$

$$ \mathbf{d} \leftarrow 0 $$

$$ \mathbf{d} $$

(37)

Substituting the displacement in equilibrium equations the reaction can be obtained by multiplying rows of stiffness matrix that correspond of fixed degree of freedom with displacement vector.

The reaction vector can be formulated in the procedure shown below:

$$ \mathbf{v} \leftarrow \text{for} \ i \in 1..\text{nel} $$

$$ \mathbf{a} \leftarrow \mathbf{d}b_j $$

$$ \mathbf{v} \leftarrow \mathbf{K}_{(a, i)} $$

$$ \mathbf{v}1_{(j, i)} \leftarrow \mathbf{K}_{(a, i)} $$

$$ \mathbf{v}2 \leftarrow \mathbf{v}1 \cdot \mathbf{d}p $$

for $i \in 1..\text{rows}(\mathbf{v}2)$

$$ \mathbf{v}1 \leftarrow \mathbf{v}2 $$

$$ \mathbf{v}1 \leftarrow 0 $$

if $|\mathbf{v}1| < 0.0001$

$$ \mathbf{v} $$

(38)

For stresses determination use the nodal displacement computed in the global coordinate system, once they are transformed to the element coordinate system for each element. For stresses determination we will used the next equations:

$$ \Delta \mathbf{L} = \frac{\mathbf{N} \cdot \mathbf{L}}{\mathbf{E} \cdot \mathbf{A}} = \mathbf{L} \cdot \mathbf{E} $$

$$ \Delta \mathbf{L} = \mathbf{u} \cdot \mathbf{u} $$

Comparing equation (39) and (40), we observe that the stress in element cross section is:

$$ \sigma = \frac{(\mathbf{u}_e - \mathbf{u}_i) \cdot \mathbf{E}}{\mathbf{L}} $$

(41)

The stresses vector can be formulated in the procedure shown below:

$$ \mathbf{tens} \leftarrow \mathbf{xx} \leftarrow 0 $$

for $i \in 1..\text{nel}$

$$ \mathbf{a1} \leftarrow \mathbf{cl}_{(i, 2)} $$

$$ \mathbf{a2} \leftarrow \mathbf{cl}_{(i, 3)} $$

$$ \mathbf{a1x} \leftarrow \mathbf{a1} - 2 - 1 $$

$$ \mathbf{aly} \leftarrow \mathbf{a1} - 2 $$

$$ \mathbf{a2x} \leftarrow \mathbf{a2x} - 2 - 1 $$

$$ \mathbf{a2y} \leftarrow \mathbf{a2y} $$

$$ \mathbf{dp} \leftarrow \mathbf{dp} $$

(39)

$$ \mathbf{dp} $$

(42)

For stresses determination we will used the next equations:

Substituting the displacement in equilibrium equations the reactions can be obtained by multiplying rows of stiffness matrix that correspond of fixed degree of freedom with displacement vector.

The reaction vector can be formulated in the procedure shown below:

$$ \mathbf{f} \leftarrow \text{for} \ i \in 1..\text{nel} $$

$$ \mathbf{c} \leftarrow 0 $$

$$ \mathbf{f} \leftarrow \mathbf{f} \leftarrow \mathbf{f} $$

$$ \mathbf{f} \leftarrow \mathbf{f} $$

$$ \mathbf{f} $$

(43)

The nodal forces vector, contain the active and reactions forces that loading the nodes of structure.

4. RESULTS

Finite element analysis is performed to obtain the deformation of the structure as well as the stresses and forces in each element and reaction in joints.

For the truss shown in figure 4 loading with active forces in two nodes the results are shown below.

Element stresses are show below. The first column, contain element’s number and the second column contain the normal stresses $\sigma$ [MPa].
\[ \sigma = \begin{bmatrix} 1 & -161.8 \\ 2 & 89.7 \\ 3 & 161.8 \\ 4 & -179.5 \\ 5 & 577.8 \\ 6 & -141.0 \\ 7 & -577.8 \end{bmatrix} \] (44)

The nodal displacement, are show below. In the first column there are, degree of freedom and correspondent displacement \( \delta \) in global coordinate system and the second column contain the values of nodal displacement in [mm].

\[ \delta = \begin{bmatrix} 1 \Rightarrow \delta_{1x} & 0.488 \\ 2 \Rightarrow \delta_{1y} & 0 \\ 3 \Rightarrow \delta_{2x} & 4.869 \\ 4 \Rightarrow \delta_{2y} & -5.589 \\ 5 \Rightarrow \delta_{3x} & 1.343 \\ 6 \Rightarrow \delta_{3y} & -8.608 \\ 7 \Rightarrow \delta_{4x} & 3.158 \\ 8 \Rightarrow \delta_{4y} & -3.858 \\ 9 \Rightarrow \delta_{5x} & 0 \\ 10 \Rightarrow \delta_{5y} & 0 \end{bmatrix} \] (45)

The nodal forces are show below. In the first column there are degrees of freedom and correspondent projection of forces Fx and Fy in global coordinate system and the second column contain the values this forces in [kN].

\[ \text{Nodal forces} = \begin{bmatrix} 1 \Rightarrow F_{1x} & 0 \\ 2 \Rightarrow F_{1y} & 87.5 \\ 3 \Rightarrow F_{2x} & 0 \\ 4 \Rightarrow F_{2y} & 0 \\ 5 \Rightarrow F_{3x} & 0 \\ 6 \Rightarrow F_{3y} & -400 \\ 7 \Rightarrow F_{4x} & 300 \\ 8 \Rightarrow F_{4y} & 0 \\ 9 \Rightarrow F_{5x} & 300 \\ 10 \Rightarrow F_{5y} & 312.5 \end{bmatrix} \] (46)

5. REFERENCES
COLLABORATIVE LEARNING ENVIRONMENT FOR BIOPROCESS CONTROL

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ABSTRACT: The paper presents a software platform that allows to multiple teams of teachers and students to perform experiments in bioprocess control on facilities situated at remote location and to share the teaching experience. The architecture of the platform is based on a collaborative multi-user online virtual world in which the real facilities are replicated so that each participant can observe and interact with them indifferent of its and their physical position. The data of each experiment is collected in a distributed database to be reused in the educational process. An in-world chat system permits the users to form teams, to cooperate and to give and receive teaching assistance unaware of the physical distance. An experiment performed at two locations is presented with its setup, teaching goals and a short after action report is presented. The main benefits of the environment are the enhancement of the learning experience, the stimulation of the team work and the sharing of facilities.

1. INTRODUCTION

1.1. Context

The using of experiments in the teaching process is of great didactical importance [1]. Experiments involving bioprocesses at pilot scale have following particularities:

- the long duration of such experiments (days);
- slow rate of change for large period of time with short events that change dramatically the behaviour (growth phase changes);
- the relatively noisy environment (disturbing on long term);
- the relatively small free space in the vicinity of the plant;
- the necessities for the participants to wear protective equipment and to know and obey to some rules.

This condition makes unpractical the simultaneous direct participation of bigger groups of students to such type of experiments.

One solution to this problem is the telepresence [2]. By allowing remote access over the net to the control interface of the process, most of the problems related to the physical presence in the bioprocess room are solved. But this solution is also scaling bad for a large number of simultaneous users and provides none or weak support for the communication between the participants. Communication in every form — per-to-per or broadcasting — is of high importance in an educational environment.

The other solution is those of virtual worlds or virtual meeting places [3], which allows the virtual simultaneous presence through the so called avatars of many users in the same virtual space. Communication between users sharing the same virtual space is similar to face-to-face communication in a real space and, in some circumstances, without the psychological barriers of physical proximity. In this case the problem is the interaction with the real world. A supplementary interface, custom developed for each case is needed for this interaction. This can imply a considerable development effort and can be difficult when the hard and soft interfaces to the real life installations are legacy and/or proprietary.

The apparition of free open platforms [4] that allows the mixing of the two paradigm using standard Web techniques and interfaces makes feasible the development of an collaborative learning environment for bioprocess control that will permit the remote simultaneous access of larger groups of students and teaching staff to bioprocess experiments.

This kind of platforms opens the way to the resource-sharing — in this case the bioreactors — which provide ways to cost and time effective exploiting them. This paper describes the implementation of an environment for the collaborative performing of bioprocess control experiments on two geographically distant locations.

1.2. Problem

The localisation of the physical resources that should be shared is presented in figure 1.

![Figure 1. Resource location](image)
developed should provide virtual access to any of these three bioreactors to the students and teaching staff performing a common experiment. This approach implies that when real experiments are performed on the bioreactors by a small team (teacher and 4-5 students), any participant from a remote location having a PC connected to the faculties networks and corresponding access rights to the environment should be able to observe and interact with the process.

2. MATERIAL AND METHODS

The used bioreactors are:

- a small scale bioreactor product of Sartorom (SSB-S) with a capacity of 2 L and the control software BIOSCADA at the ULBS-L;
- a medium scale bioreactor product of Pierre Guerin (MSB-S) with a capacity of 10 L and the control software NEPTUN at the ULBS-L;
- a small scale bioreactor product of Pierre Guerin (MSB-C) with a capacity of 2 L and the control software NEPTUN at the UBB-L.

Each bioreactor has a data acquisition and control hardware connected to the computers running the SCADA software through an Ethernet link.

Three standard laptops running Windows XP and having an Ethernet link were used as SCADA station.

One Gigabit Ethernet switch was used at each node to connect the components of the system.

A two socket Intel S5500 series server with two Gigabit Ethernet network interfaces, running Debian 4.0 (etch) Linux was used as communication and application server at the ULBS-L node.

Due to the lower load, a standard Intel PC was used at the UBB-L node as communication server.

Squeak Smaltalk [5] is used as development environment because of its advantages as a developing tool and because it provides two frameworks for the pursued goal: Seaside [6] for the development of web application and Croquait/Cobalt as virtual world browser application and construction toolkit TightVNC [7] was used as a desktop remoting tool. Blender and Google SketchUp were used in the development of the virtual world scenery and avatars.

3. ARCHITECTURE OF THE SYSTEM

The architecture of the system is presented in figure 2. At each of the two nodes an “island” (virtual 3D space) was created and populated with 3D objects. The resulted spaces are virtual, simplified replicas of the two laboratories.

Every interaction with this environment is performed through an avatar that is a 3D representation of the user that can be moved around in the virtual space with the mouse and the keyboard. Between the two islands a bidirectional link is established. The Cobalt/Croquet platform uses the portal designation for this links. An avatar can move from an island to another by traversing the windows that represents the link portal (through-the-looking-glass metaphor borrowed from Lewis Carroll).

The user can access in this way the resources present in the other island. Each of the islands contains windows that are remote connections trough VNC to the laptops running the control software. The SCADA interface is reproduced in the window and every mouse or keyboard event is propagated over the network so that the bioprocess can be observed and controlled from the virtual island.

---

Figure 2. Architecture of the system
To enhance the immersive sensation, the ULBS-L island has also a connection to an IP camera. The camera points to the bioreactor so that real operation like preparation or discharging can be followed. The SCADA software is generating for each experiment a log file in a proprietary format ASCII text file. A small program was written to monitor this log files and to write the changes to a DBMS installed on the communication node. The stored Data is available trough a web interface that is accessible also from the island.

In order to participate to an experiment, a user should open an portal to one of the two islands.

4. IMPLEMENTATION

In order to protect the data acquisition sources from unauthorized access and to reduce the network traffic, a separate local network was configured.

At the ULBS-L node a local network was installed that connects:
- the controller for the SSB-S;
- the SCADA laptop for the SSB-S;
- the controller for the MSB-S;
- the SCADA laptop for the MSB-S;
- the IP camera;
- the secondary network interface of the Intel server.

The Intel server primary interface was connected to the ULBS LAN. The server was configured as a gateway between the campus network and the acquisition network and act as a firewall for the last one. The server has a Public IP so that its island is accessible from outside of the campus LAN. On each of the SCADA laptops a VNC server is running. The VNC servers were configured to permit two kind of access: full and view-only. On the server, two Squeak (virtual machines) VMs are running. One of the VMs is using a Croquet image and the other a Seaside image. In the Croquet image an island was created. The laboratory walls, furniture and the bioreactors where schematically represented using the Sketch-up software and imported in the island. An avatar was created for the island that will represent the person from the teaching staff conducting the experiment. In order to control the access to the island, the authentication and authorisation information was added to the corresponding data dictionary in the image.

Two VNC windows were created and configured to connect to the two SCADA laptops. The teacher can choose at the experiment time if it will connect to the display in full mode — allowing interaction with the experiments — or in full or in view-only mode. A window is configured to connect to the IP camera and to show image of the PSB-L.

Similar operations were performed for the UBB-L node with the particularities that the system includes only one SCADA laptop beside the communication PC and has no IP camera.

The portal connection was configured on the UBB-L side because the UBB-L has no public IP address so in order to establish a link it must call the server of the ULBS-L that has one.

On all computers that will be used by students to access the environment, a Squeak VM was installed with a modified Cobalt image. This contains a simplified variant of the Cobalt browser, allowing only the selection of the avatar and a preconfigured link to one of the two islands.

5. FUNCTIONING

The functioning of the system will be explained trough the presentation of an After Action Report of a bioprocess experiment performed with the use of the environment at both location. The experiment consisted in the cultivation of the strain Saccharomyces cerevisiae in the three bioreactors at the ULBS-L and UBB-L to which students of the two laboratories had taken part trough the use of the environment. The goal for the students was on one side to identify the problems related to the control of the same process at different scales, and on the other side to use the knowledge gained trough supervised learning on one bioreactor for the control of the other.

In preparation of the session a schedule and a short descriptions of the experiments was distributed, together with the contact details trough e-mail to the participant classes.

Before the experiment, the teachers in the two labs have configured the environment. They initiate the island on the two communication computers. After starting the SCADA programs, the corresponding VNC windows in the virtual laboratory were opened. Because the cultivation in the SSB-S is used only to show the problems related with the scale-up/scale-down of an experiment, its VNC window is opened in view-mode only. The VNC windows corresponding to MSB-S and MSB-C should allow interaction so they were opened in full-mode. In this case, in order to prevent accidentally concurrent interactions with the SCADA software, the inputs were suppressed on the laptops on the duration of VNC connection. In the ULBS-L the camera was positioned for the best picture and its window was opened in the virtual lab.

At the scheduled time point the participants to the experiment have opened the link portals to the virtual laboratory at the ULBS-L node using the connection data provided by the teacher. By conducting their avatars trough the portals they join the virtual laboratory.

In the same virtual space, the avatars can interact with each other mainly trough the in-world chat system. The typed text appears as speech balloons that can be viewed by the other user.

Two characteristics of the environment make observation much easier for the user in the virtual world as in the real world: the possibility of scaling the avatar and the possibility of changing the point of view.

The first part of the experiment has dealt with the preparation of the experiment. Because this implied physical manipulation of the bioreactor it was mainly followed trough the IP Camera window. As students located in the real lab performed the task the teacher’s avatar has indicated the point of interest where attention should be concentrated. The activity was recorded for later replay.

After the bioprocess was started, the attention was focussed on the VNC windows with the SCADA interfaces. While interaction was the same as with the laptops, in the virtual laboratory the teacher could arrange and scale the two windows in any suitable configuration in the three dimensional space and this configuration was simultaneously accessible to all participants. The teacher has used this possibility for a side by side comparison between the effects of regulatory measures at two different scales charted by the two interfaces. He also has opened supplementary windows that had shown the inner arrangement of the two bioreactors. He had stimulated the
students to find correlation between the geometrical configurations and the observed differences and similarities.

All the participants then traversed through the link between the two virtually laboratories to the UBB-L node. At this location a similar bioprocess was prepared on the MSB-C. By using the SCADA interfaces, students received the task to configure and start the cultivation by themselves, using the knowledge acquired on the previous experiments.

After both bioprocess have ended their transitory incipient phase and have entered in the slow changing culture phase, the virtual lesson was ended. Each participant has brought its avatar back through the portal and had closed its browser. The virtual laboratories were not closed, in order to allow to each of the participants to inspect the evolution of the experiments during the three days of cultivation. During the experiments, at predetermined time points or when an event, such as the change of growth phase, occurred, the participants were again virtually reunited to analyze the evolution, debate the causes and propose control strategies.

A final meeting was held at the end of experiments, when the physical operation related to the ending of the bioprocess where performed.

6. CONCLUSION

The environment presented in this paper offers solution to the problems that arise from the use of bioprocess experiments in teaching.

Although such experiments take days to complete, the students have the possibility to access them virtually from everywhere at anytime in a collaborative environment. Because they can be alerted and can reach the virtual laboratory almost instantly, the students can detect and observe the short events that change dramatically the behaviour (growth phase changes) without the need of direct physical presence in the real laboratory over the periods with slow rate of change.

The learning experience is also enhanced by the isolation of the virtual laboratory from the noise of the real environment that can act as a disturbing factor on the long term. This makes longer session possible when needed.

The major enhancement is the possibility to use larger groups of students without the negative effects of their being physically crowded in a small space. In the virtual world each of the students maintains his freedom of movement and a good view on the observed object. Combined with an enhanced communication system, this can help transforming the group of students in a wise crowd [8].

The possibility of sharing the two resources is also high. By using one facility, the two stage learning process (exposition and learning by doing) would have necessitate 2 successive experiments i.e. double the time. In the two node configuration the two experiments are separated only by the setup time.

The advantages must be not overestimated and not be abused. The question to answer is where the students will work in the future. Although the virtualisation and telepresence gains more and more importance an all workplaces, the real interactions are predominant. So a healthy alternation of virtual and real experiences is necessary.

7. ACKNOWLEDGEMENTS

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ONLINE SOFTWARE APPLICATION FOR MILLING CUTTING

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ABSTRACT: Traditional learning is changing and evolving from day to day, especially now in the Internet era. The main purpose of this paper is to offer a modern learning tool for students in the milling cutting area. An online software application was created, together with an e-learning platform meant to teach students the basic theoretical notions before using the software application. The paper ends with a survey, in order to find user’s reaction to the software, and to improve the quality of the e-learning platform.

1. INTRODUCTION

Internet is no more something new to the people around the globe. It is estimated that around 1 billion people have Internet access today. That is why traditional learning is changing and evolving from day to day. The e-learning is taking over, helping students around the world to learn with the click of a button. The e-learning methods are very accessible and visually attractive.

The milling cutting industry is evolving as well; and there is a strong need for specialized people. So, applying e-learning methods for students is a must. What is so special about these methods is that what seemed to be very difficult in the past now becomes very attractive and relatively easy to understand for everybody.

In this paper we focus on creating an online application for understanding the milling cutting parameters. We decided to create an e-learning platform around this application, to maximize its potential. So students will be able to learn theory, to verify what they have learned and finally to apply their knowledge with the help of an application. Also, it is very important to find the feedback of the students. That is why we also created a survey so we can improve our final results.

2. E-LEARNING PLATFORM

In order to help students understand the courses and how to run the application, we have created an e-learning platform. This platform is accessible via the Internet and students can access it at any moment of the day.

The e-learning platform contains three different parts: an online course, an online quiz and the online application area, where users can apply what they have learned.

2.1. Online Course

Before creating the course, we have to consider which its objectives are. The online course aims to teach students the basic notions they need to know in order to use an online software application for milling cutting.

The theory is presented in an attractive graphical manner, using relevant images and descriptions. The format of the course is Adobe Flash; this way it can be used online and shared with other students. The course contains many different slides, making it easy for students to browse back and forward, to find the required information.

Different gradual analogies from everyday life to technical knowledge have been created to help students understand easier what’s happening in the milling process.

In the figure below for example (figure 1), there is presented a man shoveling the snow. When he wants to shovel at a higher depth, he also needs a higher force. This aspect is also available for milling cutting. If the axial depth of cut ($a_p$) is higher, the cutting force increases as well.

![A longer curb means a higher feed](image1.png)

![A higher depth requires a higher force](image2.png)

Figure 1. Online course – slide screenshot.

Calculating spindle speed and feed speed for milling operation

$$
\text{spindle speed } n = \frac{v_c \cdot 1000}{\pi \cdot D_c} \quad (\text{rpm})
$$

$$
\text{feed speed } v_f = n \cdot z_x \cdot f_x \quad (\text{mm/min})
$$

Figure 2. Online course – slide screenshot.
2.2. Knowledge Quiz

After the learning process is over, students must be tested. If they pass the test, they will be able to enter the online application area. If they do not pass the test, students will have to learn again and take the test again with another occasion.

The format of the quiz is also Adobe Flash (figure 3); questions are presented on different slides and answers are chosen with the click of a button. When all questions are answered, students receive their final score; and depending on this score they advance to the application area or not.

Figure 3. Online quiz screenshot.

2.3. Online Software Application

This application can play an important role both on education and commercial scale. The results are presented in an attractive graphical manner. Graphics and images are very important when we talk about educational products. They help students learn in an easier way and also make them more focused.

There are a lot of courses about metal cutting available today. While theory may not be so easy to understand for everybody, it is important to come with educational software that helps students understand better what is really going in the cutting processes.

This application was created with the slogan “user first” in mind. The user must be able to understand and visualize what is happening when input data are modified and how do these affect the other cutting parameters.

We present an algorithm (figure 4) that shows the steps that users/students need to follow to use the application. It is assumed that we know the material, the surface quality we have to obtain, its shape and dimensions. We have to choose the cutting diameter and the number of teeth. Then we are able to set the radial and axial depth of cut, the feed per tooth and the cutting speed. These parameters must be set depending on the properties of the surface that needs to be obtained, the material of the tool, and so on. Next, we are able to calculate according to the course formulas, the spindle speed and feed speed and find the cutting force per mm², the average chip thickness, the machine power demand and the material removal rate.

But the software can be used just to see what is happening in the process as well. By increasing and decreasing input parameters, we can see how output parameters are affected. And it is so much easier to understand this process by visualizing it.

Figure 4. Steps for using the application

The software application was created using Adobe Flash (figure 5). The software can be exported as .swf Flash file or simply integrated into a website. So users can access it online via Internet with the click of a button.

Figure 5. Online application for milling cutting.
The application has two main parts. In the left side there is the input data section; while in the right side we have the output data section.

Through the input section we can adjust the following parameters:

- cutting speed \( v_C \) (m/min)
- cutter diameter \( D_C \) (mm)
- feed per tooth \( f_z \) (mm/tooth)
- radial depth of cut \( a_r \) (mm)
- axial depth of cut \( a_e \) (mm/tooth)
- number of teeth \( z \)
- machine efficiency \( \eta \)
- cutting force per mm\(^2\) \( k_C \) (N/mm\(^2\))

In order to calculate the cutting force per mm\(^2\), a second application was created (figure 6).

**Figure 6.** Online application for calculating the cutting force per mm\(^2\).

The second application also has two parts. In the left side there is the input data, while in the right side there is the output data.

The input data contains the following parameters:

- material: 22 Seco® material groups have been used cutter diameter \( D_C \) (mm)
- feed per tooth \( f_z \) (mm/tooth)
- radial depth of cut \( a_r \) (mm)
- \( \gamma_0 \) Angle
- cutter position (center or off center)

The output section contains data about:

- cutting force per mm\(^2\) \( k_C \) = \( 1 - 0.01 \cdot \gamma_0 \cdot k_{c1.1} \) (N/mm\(^2\))
- spindle speed \( n \)
- feed speed \( v_f \)
- metal removal rate \( Q \)
- power demand \( P_C \)

We will present an example of the online application (figure 7). After setting the input parameters, we are going to modify the feed per tooth (mm/tooth). We can easily notice how the feed per tooth influences the feed speed (mm/min), the metal removal rate (cm\(^3\)/min) and the power demand (kW). We have increased the feed per tooth from 0.1 mm/tooth to 0.145 mm/tooth. We can observe that the feed speed modified from 318 mm/min to 461 mm/min; the metal removal rate increased from 127 cm\(^3\)/min to 184 cm\(^3\)/min and the power demand increased from 3.5 kW to 5.19 kW.

Of course, it is obvious that these parameters cannot be increased the way we want. We have to take into account a lot of factors like the material we are machining, the dimensions we have to achieve, the material of the tool, the milling machine we are using, and so on.

**Figure 7.** Example of using the application
By visualizing these comparative graphics, students can understand better what is going on behind the theory. It has been shown by specialized literature that comparative graphics are a great way of learning for students.

2.4. User Guide

We will present the steps that a user needs to take in order to obtain and visualize results with our application.

First, the user needs to learn the online course. Then, the user does the testing. If he passes the test, the user will be allowed to run the application.

These steps are integrated in the e-learning platform, making it impossible to advance to a higher level if the lower levels are not passed.

The results were centralized and visual pie charts were obtained for each of the questions (figure 10). By analyzing the results, we observe the weak parts of our e-learning platform and we can take measures to improve it periodically.

When a new group of students will access the platform we will run the survey once more and this way we will keep on improving our results.

Figure 9. User survey – partial screenshot.

4. CONCLUSIONS

The main conclusion of this paper is that our e-learning platform and the online application have big potential. By doing an online research we couldn’t find in Romania a similar application for milling cutting and this makes it even more special.

The application is not useful only for students. It can be developed even at a commercial scale, because even in production, engineers need to calculate or verify different cutting parameters and the application can do this very fast.

This method can be applied for other related courses as well. This was intended to be just an example. Actually, this can be just a part of a much larger e-learning platform.

5. REFERENCES

TECHNOLOGIES FOR DATA ACQUISITION AND MONITORING OF MEASURED PARAMETERS OVER INTERNET

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ABSTRACT: The real time measurement and monitoring over long distances can be made easily by Internet. Different modalities for presenting of measured data can be used, like dynamically web publishing technologies, continuously transmission of the measured data over Internet using data streaming techniques, client server architectures, etc. This paper presents an application for data acquisition and monitoring over Internet suitable for environmental parameters monitoring. The application was implemented in LabVIEW, a graphical programming language dedicated for data acquisition applications. The transmission of the multiple parameters measured is made using DataSocket streaming technology.

1. INTRODUCTION

The need for remotely measuring and monitoring of multiple parameters in different kind of application (environmental, industrial, home appliance, medical, etc) led to development of multiple technologies for data transmission and application control [1]. The Internet is the most spread and accessible way for communication and data transmission. The growing usage of the wireless access in the computer networks in the last time give the mobility of measuring and monitoring equipments, making possible to use mobile computers like laptops, PDA, or even mobile phones for accessing measured data. This requires new technologies to be developed for data transmitting within these communication systems.

Another domain suitable for the internet communication based applications is the educational domain, where laboratory experiments can be accessed and settled remotely by the students in case of distance learning. One of the most used software for easily development of applications for data acquisition and control is LabVIEW from National Instruments, which also have a number of different methods to operate, monitor, and/or control an application (such as an experimental setup) via Internet/World Wide Web.

The paper focuses on the technologies for data transmitting within these modern communication systems that uses packet switching technology.

There are two types of applications that use the internet network: Web-based applications (www) and Internet/Network-based applications. LabVIEW has built-in support for both types of applications, and we focused on the On-line methods that permits interfacing LabVIEW applications with the Internet/www.

There are four types of technologies for sharing information and data on the Web [1]:

- Remote Control – Expands the concept of sharing data to include enabling another computer to connect to the experiment and control that experiment remotely.
- Distributed Execution – Combines several of the concepts by developing a system architecture that shares the acquisition and analysis of the measurement system among several computers. The distributed systems consist of measurement nodes that can transfer data between computers, so different parts of the test can run at different places, and the data still can be correlated and used to control other hardware items.
- Remote Viewing – Enables another computer to connect to the application or the use of adds-on software systems. The most used methods are:
  - CGI technology - (Common Gateway Interface) essentially is a standard for the construction of dynamic Web pages by external programs installed on a Web server. In other words, CGI defines an interface protocol by which a Web server communicates with other applications.
  - DataSocket and ActiveX - Datasocket is a technology developed by National Instruments to facilitate live data exchange between LabVIEW based applications over the Internet/Web without any TCP/IP programming. The combination of data socket and ActiveX technologies could be used to build interactive LabVIEW Web-based applications.
  - Remote Viewing using LabVIEW Built-in Web Server - the simplest method of interfacing a LabVIEW application with the World Wide Web. In this method, panel images of the application can be constantly broadcast to users through the Web at relatively short time intervals.
• DataSocket and Java applet – this method combines DataSocket technology with Java programming for building Java Applets that can be embedded in an HTML file for the Web viewing.
• AppletVIEW – is a technology developed to design Java Applets that interface with LabVIEW. Using this technology allows the application developer to design Applets without any Java programming and other requirements mentioned in the previous section.

2.2. Internet methods in LabVIEW
The internet/network methods use the TCP/IP protocol to build Internet-enabled applications. These applications use the Client/Server architecture. The major internet methods are:
• Client-Server using LabVIEW built-in TCP/IP functions – the server and client applications use LabVIEW software for development of application and thus there is no need for any additional programming or adds-on software systems. The two general categories of this model are single-client and multiple clients
• VI Server – is a facility in LabVIEW to build client server applications over TCP/IP for networked computers using and embedded VI server in LabVIEW.
• DataSocket – is a technology that permits exchange live data between local and remote sites (streaming). It uses a Datasocket server that can be easily configured and simplify the application programming.

Table 1. Comparison between LabVIEW technologies for Web/Internet applications

<table>
<thead>
<tr>
<th>Technology</th>
<th>Application development</th>
<th>Data transfer</th>
<th>User interaction</th>
<th>Security</th>
</tr>
</thead>
<tbody>
<tr>
<td>REMOTE VIEWING</td>
<td>very simple</td>
<td>limited (no live data)</td>
<td>none</td>
<td>good</td>
</tr>
<tr>
<td>CGI</td>
<td>Relatively difficult</td>
<td>Moderate (no live data)</td>
<td>Moderate</td>
<td>good</td>
</tr>
<tr>
<td>DataSocket and ActiveX</td>
<td>Moderate difficult</td>
<td>Good (supports live data)</td>
<td>good</td>
<td>Not so good</td>
</tr>
<tr>
<td>DataSocket and Java Applet</td>
<td>Not very difficult</td>
<td>Good (supports live data)</td>
<td>Very good</td>
<td>good</td>
</tr>
<tr>
<td>AppletVIEW</td>
<td>Relatively simple</td>
<td>Good (supports live data)</td>
<td>Very good</td>
<td>good</td>
</tr>
<tr>
<td>Client server (TCP/IP)</td>
<td>difficult</td>
<td>Very Good (supports live data)</td>
<td>Very good</td>
<td>Very good</td>
</tr>
<tr>
<td>VI server</td>
<td>Relatively difficult</td>
<td>Good (supports live data)</td>
<td>good</td>
<td>Very good</td>
</tr>
<tr>
<td>DataSocket</td>
<td>Not difficult</td>
<td>Good (supports live data)</td>
<td>good</td>
<td>good</td>
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</table>

3. DATASOCKET TECHNOLOGY
DataSocket is a programming tool which provides an API (Application Programming Interface) which enables the exchange of data between distributed applications. The dataSocket protocol (dstp) represents a mechanism that offers the possibility of monitoring of the most recent data over Internet. It was developed by National Instruments to simplify programming for live data exchange through Internet.

By means of DataSockets it is possible to use various different data structures as well as control and communication mechanisms at a higher level with the aid of a standard interface without having any knowledge of the respective mechanisms and structures. DataSocket automatically recognizes various different protocols and data formats.

DataSocket provides mechanisms for publishing and subscribing of data.

Dstp is an application-layer protocol for transferring measurement data to and from a DataSocket server [2], [5]. Dstp is implemented on top of TCP, and hence provides connection-oriented communication between the server and the client.

A dstp data exchange usually consists of three components (figure 1):
• DataSocket server – broadcast live data and restricts access to data by administering security and permissions.
• publisher (writer) – acquires data and sends it to the server
• subscribers (readers) – clients who subscribe to receive data from the DataSocket server.

The three DataSocket entities can reside on the same computer or on different machines over the network.

The algorithm for establishing an internet connection using DataSocket is following:
• opening a session using the DataSocket API Interface, by sending the URL; the steps for establishing the connection are executed by DataSocket Clients without the user intervention.
• transferring data – writer sends data to be published to the DataSocket server; data is encapsulated into a message that includes the URL identifying the data on the server; then, a subscribing application reads the data from the DataSocket server by sending a message that requests the most recent value of the data.
• terminate a connection - client sends a request for disconnect to the server.

Figure 1. DataSocket technology
For dstp communication, there are four functions, grouped in DataSocket (DS) library. These functions are: DataSocket Read, DataSocket Write, DataSocket Open and DataSocket Close (Figure 3).

4. APPLICATION FOR REMOTE MONITORING OVER INTERNET

The architecture of the system used for measuring and monitoring of measured parameters is presented in figure 4, and the software application for remote monitoring over internet using datsockt protocol developed in LabVIEW is presented in figure 5.

For temperature measurement, a LM35 integrated temperature sensor that has sensibility of +10mv/ °C in the temperature range –55 to 150 °C was used.

The application (virtual instrument) that makes the temperature measurement and data transmission over the network, using dstp protocol, is called temperature monitoring – DS writer. The bloc diagram (code) of VI is presented in fig. 5 b). It starts with opening of a datassocie connection; measured data are then plotted to local application front panel and published to datasocket server within a while loop. Temperature is read from presented data acquisition hardware by using subVI Read temp data.vi.

The client application (reader) for remote temperature monitoring, that reads data from Datasocket Server is called Temperature monitoring – DS Reader and is presented in figure 5.c). The reader application must subscribe to the datasocket server using the same URL specified by the publisher. More readers can connect and monitor data from the server simultaneously. The application interface is presented in figure 5.a.
5. CONCLUSIONS

DataSoket technology provides a very easy way to implement applications for remote monitoring over the network or internet. Using this advantage, the programmers can focus on the measurement and data processing operations, and not to the communication between applications.

The TCP programming requires more complex code to implement the communication and experienced programmers, because they have to do a low level programming. DataSocket uses the same TCP-IP networked, but it is on top of the TCP, so users must not deal with low level TCP programming techniques.

Combining the internet communication technologies together with other mobile communication technologies in a measurement and monitoring system increases the flexibility and mobility.

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INNOVATIVE FPAA BASED PLATFORM FOR STUDY OF COMMUNICATION CIRCUITS AND TECHNIQUES IN UNIVERSITY LABORATORIES

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ABSTRACT: The current trend in the electronic industry is to realise complex systems based on the concept of reconfigurability. In the field of communications, the implementations of advanced software defined systems necessitate highly reconfigurable hardware devices for analogue and digital signal processing. In this paper is approached the problem of generating modulated signals using a reconfigurable platform based on FPAA (Field Programmable Analogue Array). In the experiments it was used Anadigmvortex - AN221E04 circuit included in a development board connected to PC through a serial interface. For simulations of the implemented circuits it was used the software tools named AnadigmDesigner2 which benefits of an reach library of devices and ensures a simple and friendly graphical interface.

1. INTRODUCTION

The advantage of field programmable analog arrays (FPAA) devices in comparison with classical circuits is represented by reconfigurability. This circuits offer the possibility to change their operation in function of applications without been necessary to make hardware changes. Until the advent of FPAA, this attribute was characteristic only to FPGA (field-programmable gate array) but now it is possible to implement the concept also in analog domain. The idea of using FPAA (Field-programmable analog arrays) for the variable design of analogue circuits dates back to the development of the first integrated circuits. But, as the progress in programmable digital circuits rushed forward in huge steps, the evolution of programmable analogue circuits proceeded only slowly. But recently arrived FPAA is making the migration of the designs towards Field Programmable Mixed Arrays (FPMA) which are the combination of both FPGA and FPAA.

In this context it is easily understandable that FPAA circuits can be also used for didactical purposes, allowing the study of different architectures and circuits based on the same hardware structure. In this paper the presented applications refers to communications domain. The hardware and software platform allow the analysis of a variety of circuit configurations. The created platform facilitate an better understanding of the theoretical operation principles of the analysed structures, allowing versatile changes in almost any parameter of design. Practically, in this way almost any design idea can be simulated and after that can be hardware implemented in order to be tested.

This represents a very modern approach that can greatly support the engineering education in the field of communications circuits but also in the broader domain of signal processing and electronic circuits.

The platform based on Anadigmvortex - AN221E04 circuit represents an development board that is connected to PC through serial interface. The simulations of the implemented circuits is realized with software tool named AnadigmDesigner2 which benefits of an reach library of devices and ensures a simple and friendly graphical interface.

2. FPAA OPERATION

A generic FPAA contains an array of configurable analog blocks (CAB), configurable switches, and a configuration memory which stores the configurations of the cells and their interconnections. The most important elements in a FPAA are the Configurable Analogue Blocks (CAB) which manipulates the signals and the interconnecting routing network. The analogue functions to be implemented are defined by a set of configuration bits loaded into an on-board shift register.

Each CAB can implement a number of analog signal processing functions such as amplification, integration, differentiation, addition, subtraction, multiplication, comparison, log, and exponential. The interconnection network routes the signals from one CAB to another, and to and from the I/O blocks. Key challenges in the design with FPAA include the necessity to design for a wide range of functionalities and performance specifications. Also, another important consideration is the available bandwidth of the FPAA. Increasing the bandwidth to the 10MHz range allows the realization of video frequency circuits for example. The structure of the CAB’s components depends on the technologies used. FPAA are designed in both continuous-time and discrete-time domains.

![Figure 1](image-url) An example showing how an circuit based on switched capacitors can be configured to emulate an resistor.
A continuous-time FPAA is usually designed using an technology that has as main element the transconductor. The basic cell consists of an op-amp and programmable capacitors linked by a transconductor-based array. These devices have advantages in terms of bandwidth, but have narrow programming range for their parameters.

A discrete-time FPAA is designed with switched-capacitor or switched-current technology. Currently FPAA devices are mainly based on switched capacitor technology and this is also the option used for implementation presented in this paper. Switched capacitor techniques can provide the advantages of digital circuits in the analogue world. The advantages of this technology can be appreciated in terms of programmability. For these reason the switch capacitor approach was chosen over other technologies such as MOSFET, transconductance.

The Figure 1 gives an illustration about how switched capacitors can be configured as resistors. The sign of transfer functions can be changed by changing the clocking phase of the sample clock. For example, the rectifier function without diode can be implemented by controlling the phase based on the input signal. Switched Capacitor circuits works on the principle of sampled data systems. The input and output signals are sampled are will be valid only during one phase.

3. THE PROPOSED APPLICATION

In the realized tests, was implemented few practical methods of generating the amplitude modulated signal using just a fraction of the resources available within an Anadigmvortex - AN221E04.

This particular examples was designed to accept a low audio band input signal and use it to amplitude modulate a 100 kHz carrier. These frequencies were selected out of convenience for demonstration purposes. They can easily adapt all of the parameters to better suit specific requirements. Just few resources are required to accomplish the modulation task, leaving the balance of the array available for other signal processing functions (like demodulation).

For the implementation of the proposed linear modulators it was used AN221E04 chip mounted on Anadigmvortex - AN221K04 development board.

The program used to configure AN221E04 FPAA circuit in order to operate as a modulator was written in Anadigm 2 software. This software is an useful EDA tool that besides configuration of FPAA circuits allows also the simulation of the implemented circuits.

All the CAM’s (Configurable analog modules) used in the proposed application operates on the base of an sampling clock (Figure 3). The master clock frequency for the design that was tested in this paper is 16MHz.

The device can accept either an external clock or generate its own clock using an on chip oscillator and an external crystal. The resulting internal clock frequency can be divided down into four synchronized internal switched capacitor clocks of different frequencies by programmable dividers.

The Figure 2. Switched capacitors based architecture of FPAA devices.

Figure 3. Typical clock signals used to control the switched capacitors contained by FPAA devices.

Switched capacitor is the technique by which an equivalent resistance can be implemented by alternatively switching the inputs of a capacitor. The resistor based on switched capacitor technology has some advantages: much larger resistance value for a given area; temperature and process independent ratio; Transfer function with “Negative resistors”; corner frequencies scale linearly with sample clock; better matching; better temperature coefficient; better voltage linearity; wide range.

The Figure 4. The FPAA implementation of an chopper based linear modulator. The structure is realized in Anadigm 2.
Figure 5. Two different structures of linear modulators simulated in Anadigm 2 software environment.

The CAM’s that are used for the design are Inverting Sum Stage, Half Cycle Gain and Inverting Differentiator and two biquad filters (Figure 4).

In the first design linear modulation (AM) is actually carried out by Half Cycle Gain Cam and inverting differentiator CAM. The sampling clock of Half Cycle gain is set to 100KHz. This CAM is deciding the carrier frequency. In this implementation the carrier frequency is set to 100KHz. The sampling of the incoming modulating signal is realized on the phase 1 of carrier frequency (Figure 3). The output of the Half Cycle Gain CAM reflect the modulating signal during the phase 2 of the sampling clock and during the 1st phase of the sampling clock the output of the CAM will be at an reference voltage. Thus the output from this CAM will be a chopped base-band signal. This is an classical principle for obtaining the linear modulation. The novelty of this approach is represented by the implementation, that is carried out using FPAA. This allows unlimited changes in the structure of the realized modulator. The user can experiment many different solution without been forced to realize hardware circuits for each test that it made.

This chopped base-band signal is fed into an inverting differentiator. In a continuous time system, the output of a differentiator circuit at a particular instant will be proportional to the slope of the input signal at that same instant. But in a sampled system like FPAA, the output signal will be proportional to the change in voltage (∆V) over the change in time (∆T). The "slope" during this sample is ∆V/ ∆T. The differentiation constant k of the inverting differentiator sets the gain for the circuit. The output of the inverting differentiator CAM is given by \( V_{out} = -kAV/\Delta T \). During the 1st phase, the input signal slope will be positive which produces a negative step at the differentiator. In the very next phase, the slope will have the same magnitude, but opposite sign, and so the differentiator output will now be a positive step of the same amplitude. The result of all this will be amplitude modulated signal, with each phase's amplitude proportional to the input signal. At the output stage a low pass filter with a corner frequency in the range of sampling frequency, so as to remove the unwanted high frequency components from the output signal.

A summing amplifier is used to provide a DC offset to the input signal to keep it always above a reference voltage, VMR. Failing to do so will result in an over-modulated signal (modulation index > 1) which precludes the use of simple envelope detection for demodulation. A much more complex synchronous demodulation scheme would otherwise be required.

In Figure 6, 7 are presented the practical implementation and the results obtained with the configuration program that was downloaded in the FPAA memory. As can be seen, the circuit performs well, in accordance with the requirements.

Figure 6. Speed versus mobility for different wireless technologies candidate to the implementation.

Figure 7. The data transfer speeds available for different cellular networks including 3G.
Then the student can select one trainer (corresponding to one e-learning server) from the discovered trainer list. Chosen a specific trainer, the student can login the system with username and password. Once the student successfully logs in, the connection is setup between the client and the server. The client and the server will be disconnected when the student exits the application or the trainer stops the e-learning service.

4. CONCLUSIONS

In this paper it was presented a novel implementation solution for circuits capable to generate and process modulated signals from communications domain. The purpose of this approach was to exploit the programmability feature of the FPAA devices for better performance and higher quality in processing of communication signals.

5. REFERENCES

STUDIES AND RESEARCHES ON THE INTERPRETATION OF VISUAL IMAGES IN EDUCATIONAL MANAGEMENT

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ABSTRACT: Multimedia transforms the interaction between man and computer and permits the creation of a new products family that can be considered a catalyst to launch the second informational revolution. This new product generation permits both placement of the multimedia elements inside the existing environment and a new approach concerning the process of work. There is the problem of a new management of multimedia data base for educational processes. Image data base is a more important source for developing and more rapid learning of knowledge and in this way it contributes to the development of educational system. Through the present paper the authors find a new possibility of visual searching and finding of the information but also a statistical determination of the main methods of working with the pictures from the data base. This kind of data base may be used in all educational development’s phases of a human being, starting with individual forming. The major conclusion remains the necessity of a new and more rapid learning and adequate educational approach for the academic environment, based on this new multimedia management process (using image date bases). [HCI (HUMAN COMPUTER INTERFACES) APPLICATIONS FOR EDUCATIONAL PURPOSES]

1. INTRODUCTION

Classic learning by using writing and reading are forms that no longer fully satisfy the actual requirements. The massive grow of Web services and products are determined by using a richer informational content: images, video and sound. The combination and integration of these means forms the multimedia, used at a large scale in representation and interchange of information. This new generation of products allows the integration of multimedia elements in existing means and a new approach in the learning process. A lot of media it can lead to rethinking in a revolutionary mode the information processing in various fields such as economy, art, science, education and engineering. Using these types of elements generates benefits for all the users of the complete informational systems, improving the quality and quantity of the information presented to the user, as well as the interactions human-computer and inter-human at a global scale.

Multimedia data base achieves an union between the recovering disciplines of information and management of data bases.

The images, an essential part of the multimedia notion, represent a concept with informational character. The communication through the instrumentality of images has developed a lot in the day do day life as much as in the professional life. Many relational working activities with the computer use images. The influence of the images as well as their reception allows the realization of a visual learning process. The people with difficulties of writing and reading depend on the information processing by the medium of images. By the medium of the visual way is acquired the most of the information which their sensory system perceives. The prehistoric people painted much earlier than they written, transmitting this way selected information. Probably we could identify these pictures from the caves as the first artificial images with graphic practicability. Thousands of years the artificial images had been created by the people by graphic methods and had been interpreted in natural way entire by them. The apparition and subsequently the development of computers offer the possibility that artificial pictures will be created and memorized in numeric form.

The formative scope learning is realised by visual perception. The learning of visual perception is composed in a complex reception of a visual content which implies interpretative understanding. It is obvious that the digital multimedia information is relevant, clear, precise, safely kept, easily transmitted and beautifully presented. This is in a continuous growth and in a continuous circulation, transmitting flux.

Long ago started the flirting with the idea of creating a universal data base, a data base that would contain information from various fields, those could be accessed by a large number of users. Since the beginning people needed information. Once with the information appeared the need of information exchange. For this important aspect was needed a material support that would stock and transmit the information further. It began with chopping the information in stone and it continued with other and others solutions up to now when we assist at a myth breakdown (paper) and the rise of a new one (electro-magnetic support). Once with the human evolution, the information has grown in dimension.

2. MATHERIAL AND METHOD

Since the inception of the IT civilization it has been observed that the difficulties of putting in application the big dimension calculus as well as implementing the embryonic information technologies can be overdone by acquisition, stocking and re-finding in the first generation computers of a large volume information which could be used in educational means.

Today’s teenagers grew watching television and playing computer games and are extremely well oriented in visual learning. They use variants, schemes, images, drawings, etc which have the role of rapidly determining of the connection between the existential knowledge and the ones earned by learning process. Second, third and forth class adults frequently access the Internet and various data bases or small programs publicly available in demo versions.
2.1. Visual search based on contents

In terms of learning typology, on the first place remains the visual memory. The ones that learn respond very well at visual learning methods because it is a different learning method, implies less effort, they do not need to listen a lot, to understand, to learn and eventually use the information in a such way to be understood. In visual learning the message and information is just there the image is, but it just has to see and understand it. This explains the motive of which this kind of activity pleases the students and determines them to be involved, having in mind the fact that they consider the school difficult.

Visual learning leads to a better and faster understanding of the processes, of their functionality, a better anticipation of the problems which could appear at this approach, the practical abilities forms and develop easier.

Visual learning stimulates the development of a concrete thinking, despite abstract, formal and conceptual thinking, and facilitates the forming of mental representation and is accessible to understanding.

2.2. Comparing the images

The distinction between the searching process of a image by contents and the one of recognition of a image is mostly good. Numerous recognition systems can be used for searching images in a data base. The distinction consists the fact that in the data base case the images are available before the beginning of the search so they can be pre-processed. This way we can create structures of data off-line with too expensive algorithms for interactive recognition of objects.

There are two types of searching:
- the ones that require from the user an example image,
- and the ones that start form an interrogation in a word form.

Such systems, are far to be perfect but they can be successfully used.

2.3. General model of finding information

Below, we will present one of the general models used for re-finding information. The information form the data base is pre-processed for extracting characteristics and information of semantic nature and is indexed by those things. For the re-finding of the information, the specific interrogation of user is processed and extracts the main characteristics. Those main characteristics of the interrogations are therefore compared with the characteristics of all information articles from the data base, than finally are presented to the user the information with the same characteristics as the interrogation.

In the presented model the two important features are:
- indexing the information articles form the data base;
- and the measurement of the similitude between the interrogation and the information from the data base.

The indexing is defined like a mechanism that reduces the searching space, without losing any important information. Like in the traditional systems of managing the data base the indexing is necessary because it has as effect raising the speed of re-finding operation. The indexing is very important in the multimedia data base, which needs large memory spaces of the information. Re-finding based on direct comparison between the multimedia information articles and interrogation, is an very slow operation. Likewise, is important the re-finding or the multimedia information, clues which will capture the relevant part, important of this information, clues which are compact and fast at re-finding. The finding of these clues is difficult thing in the multimedia data case, because of syntax and semantic obvious.

The second feature in re-finding the information is the measurement of the similitude.

The wanted proprieties for the measurement of the similitude are the:
- easiness of the calculus;
- and the correspondence with the human reasoning.

The second property is very important, because the re-finding of the multimedia information is based on the similitude, not on a exact mach. The results of the re-finding must be returned to the user in an cascade order of the similitude. All the returned articles are considered relevant or similar to the interrogation object. So is ideal that this calculus of the similitude to be compliant to the human thinking, so the information articles considered similar by human must be similar after the similitude calculus.

![Figure 1. General model of re-finding the information](image)

3. AN EXPERIMENT AND ITS RESULTS

3.1. The testing

The methods presented are studied in two ways:
- Refinding quality,
- During execution.

To achieve this comparative study, we feature colour following experimental conditions:
1. We created two databases test, one with images from nature;
2. Each image in the database was processed before the completion of interrogation. This is important because it requires consumption of time and therefore is not appropriate to run simultaneously with the query;
3. He was elected a query and have been determined by a human observer images deemed relevant to the query;
4. Each of the images deemed relevant to the query, were used in turn to interrogate the database with images. Precision and recall represents an arithmetic average of the values results in images taken on each row that image query;
5. To compare the results of queries each experimental graphic precision we have achieved in relation to the recall. We presented in the form table values that represent the number of relevant images in the first five, ten images relevant question. Also the number of images to be found for then to retriever the first five, ten relevant images.

Summary of steps taken in view TESTING methods we have used it in the following chart.

![Algorithm for comparing HSV colour spaces, RGB and l1 l2 l3 -block scheme](image)

**Figure 2.** Algorithm for comparing HSV colour spaces, RGB and 1112 13 -block scheme

### 3.2. Results

Experiments disclose the efficiency of the re-finding process using the colour characteristics of the image. A set of tests had been realised on their colour backlashes.

Each image has been analyzed at the moment of inserting in the data base. After the moment of choosing an interrogation image and the display of the result refined, it applies some detection algorithms of the relevant images. By this relevant images and their number, it will be realised statistic and graphic tables. The relevant images will be interrogations for the data base, this way obtaining a number of statistic pairs equally calculated with the relevant images number for the given image. The statistical magnitudes which are calculated are called precision and re-appeal. They are the characteristics of the efficiency of re-finding the information in the data base. For this value pairs it will be done a general graphic. The graphic is very important because it helps the revelation of a conclusion of the methods efficiency and performance. The results obtained with images from nature are presented in next figures. In this case, the target is a floral image. Also in this case the returned images are similar to the target.
4. CONCLUSIONS

In the experiment we achieved, a comparative analysis on implemented methods of the colour images, using the colour decoder. Presenting a series of methods and colour backlashes we compared the efficiency between:

- RGB backlash quantified at sixty four colours;
- HSV backlash quantified at one hundred and sixty six colours;
- Backlash $l_1l_2l_3$ quantified at sixty four colours.

We have chosen these transformations because is necessary that the colour spaces will be: uniform, complete and natural. The achieved study, on the visual search based on content can be extended in different directions.

We established in which one of the three colour backlashes analyzed the efficiency is bigger, by practical experiments with the rise of some graphics and tables for the performance observing. The colour is considered to be the most important characteristic of the images.

These algorithms can be successfully used in the modern educational process, in which the stored information by classic methods can be compared with the store mode of the knowledge by visual methods. Likewise much knowledge and conclusions can be verified and confirmed by these methods. Though in the forming programs, our formers use images, video recordings and a large gamma of instruments and techniques for improving the learning process. A very well defined method for visual learning doesn’t exist. It doesn’t exist an institutionalised concept regarding learning the whole life, too.

Third case persons which want to learn don’t have a formal background for this type of education.

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CONSIDERATIONS ON SKIN COLOUR ALGORITHMS USED FOR CANDIDATE FACES DETECTION

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ABSTRACT: Skin segmentation is a major component in human-computer interaction- (HCI-) based applications such as gesture analysis, facial expression detection, face tracking, human motion tracking, and other human-related image processing applications in computer vision and multimedia such as filtering of web contents, retrieving in multimedia databases, video surveillance, videophone, and videoconferencing applications. A possibility to decrease the processing time of an image or image sequence in order to detect candidate faces is the delimitation of the areas of skin in the image during the pre-processing stage. In this paper we compare a nonparametric Bayesian classifier model with a single Gaussian distribution model, in order to detect the skin areas from the colour images in order to determine the candidate faces and we describe the construction of colour models for skin and non-skin classes from a dataset. The algorithms were implemented in several colour spaces, the luminance component being eliminated from each space. In general, the best results were obtained for the normalized RGB colour space. To decrease the rate of false detection we fused, in the same model, the binary images obtained with two colour spaces.

1. INTRODUCTION

A large number of applications require the locating of people in images or video, the most popular being face detection for recognition, gesture recognition, facial expression and hand movements. A strategy for reducing the search in the space of faces is the initial segmentation of images into skin and non-skin areas depending on the colour of the pixels. In this sense, in terms of the number of pixels used to detect skin, we can classify the utilized methods into two categories:

- Pixel-based – each pixel is independently classified as skin or non-skin, without using its neighbours;
- Region-based – classify the regions as skin or non-skin

From the point of view of the rule of decision used to classify the areas as being skin or non-skin, the methods are classified into:[14]

- Explicit threshold-based skin cluster classifiers - methods that implicitly define the defining of the candidate skin areas explicitly, according to the space colour;
- Non-parametric model - estimate skin colour distribution from the histogram of the training data;
- Parametric model – are used to the parameters of the skin colour.

The appearance of the skin in an image depends on the lighting conditions, on the manner in which the image was captured, on the camera. Therefore, the aim is to represent the colours in a space colour insensitive to lighting conditions, and numerous studies argue the fact that the RGB space color is not the best option for processing images. This is why the systems that separate the luminance and chrominance components - normalized RGB, YCbCr, HSV, L*a*b, L*u*v are actually preferred. [13]. Ethnic group differentiation can only be made by means of chromatics [15], [11], or by using all the three color levels [3], [11], [6]. The determination of the color space and of the optimal method is based on the comparative analysis of the results obtained from the delimitation of the areas of candidate skin in the colour images. In the present paper we did comparative studies between four colour spaces - normalized RGB (nRGB), YCbCr, HSV and CIELab, and two methods: a non-parametric Bayes-classification and a parametric one that approximates the skin model with a single Gaussian function. The approximation of the skin model using a Gaussian mixture, required a long time for computations, several hours. For the normalized RGB color space we only took into account the plans r and g, where r is normalized red and g is normalized green, because r+g+b=1 (r=R/R+G+B, g=G/R+G+B, b=B/R+G+B); for the orthogonal YCbCr color space only Cb and Cr chrominances, for the perceptual HSV colour space, the H and S components, for the perceptual CIE-Lab color space, the a and b components and for CIE-Lab we eliminated the luminescence.

Regardless of the utilized method, the process of classification of the skin areas and then the determination of the candidate faces can be dealt with from the perspective of three stages:
1st Stage) Training
- a dataset of skin images of different human races, in different lighting conditions is created;
- a color space is chosen;
- the parameters of the model capable of classifying pixels into a skin and non-skin areas are determined.

2nd Stage) Testing
- the test image is processed in the same colour representation space as the one utilized during the training stage;
- each pixel is classified as skin or non-skin pixel according to the model. A likelihood image in which the possible skin
pixels are lighter and in which the non-skin pixels are black/dark is obtained. Applying the threshold of segmentation obtained during the training stage, one obtains a binary image, in which the skin pixels are white and the non-skin pixels are black/dark.

3 Stage) Fusion and candidate face detection

- the binary images obtained during the previous stage are fuzzified for two of the best color spaces obtained
- typically, for candidate face determination, one resorts to morphology

2. IMAGES USED AND METRICS

The distribution of skin colors for the human races is concentrated in a small region, it is not scattered throughout the whole area. To create a dataset of skin samples we used a number of 42 images, 11,520 pixels, from 42 subjects, men and women of different races [18], and for the non-skin dataset we used the Compaq database [6].

In any color space used for representation, the characteristics of the skin can occupy a compact region or a larger one according to the human races used for representation. The classification of the pixels from the image, according to color is a problem that is reduced to the classification into one or two classes; in the present paper we utilised the classification into two classes. The chosen colour space directly influences the type of the utilised classifier. For the evaluation of the quantitative performance two metrics are used:

- TPR – true positive detection rate (or correct detection) - the ratio between the skin pixels correctly identified (TP) and the total number of skin pixels from the image.
- FPR – false positive rate (or false detection) – the non-skin pixels incorrectly labelled as real skin pixels divided with the real skin pixels from the image.

The lower the false-positive and false-negative errors, the better the classification. The obtained performance from the classification can be quantified by determining the ROC curve (Receiver Operating Characteristic) that measures, according to a fixed threshold, the correct and false detection rates. The curve is determined according to the test images for each established colour space as follows:

- for each threshold (th) from 1.0 to 0.0 (step 0.1) the correct detection rate is determined (the correctly identified skin pixels) and the false detection rate (the non-skin pixels erroneously classified as skin pixels).
- the threshold is chosen according to the optimal values obtained, “correct detection” and “false detection” - preferably the optimal value for “correct detection” and minimum “false detection” value TPR + FPR = 1 ([8], [3]) (Figure 1)

3. IMPLEMENTATION AND EXPERIMENTAL RESULT

3.1. Bayesian classifier

The idea of non-parametric modelling is to estimate the distribution of skin colour starting from the training dataset, which contain nuances of skin and non-skin. After applying this method, one obtains a likelihood matrix, in which each every pixel is assigned a probability of the color space. The Bayes classifier utilizes two histograms, one for the skin pixels and one for the non-skin pixels, and for the skin detection the posterior probability $P(skin|c)$, probability which can be determined by using the Bayes rule.

Skin classification can be defined probabilistically as [4]: given a pixel with color $c$ what is the probability of it being skin pixel $P(skin|c)$. Once this probability is computed, the pixel is labeled as a skin pixel if such probability is larger than a threshold and non-skin otherwise. Using Bayes rule, this can be rewritten as:

$$P(skin) = \frac{\sum_{c \in skin} P(c|skin) P(skin)}{\sum_{c \in skin} P(c|skin) P(skin) + \sum_{c \in nonskin} P(c|nonskin) P(nonskin)}$$

where:

- $P(c|skin)$, $P(c|non-skin)$- the conditional probabilities for a $c$ pixel to be skin or non-skin and are determined from the histograms associated to the skin and non-skin models - for a skin dataset we can estimate the probability density function (pdf) of $P(c|skin)$ and this pdf can to compute using histograms

$$P(c|skin) = P_{hist}(c) = \frac{\text{skin histogram}(c)}{\text{norm}}$$

- norm – histogram normalization (either with the maximum value [13], or with the sum of all pixel values [3],[6])
- $P(skin)$, $P(non-skin)$ – prior probabilities determined from the training dataset

Depending on the prior probabilities there are two classification techniques – MAP (maximum a posterior) the prior probabilities estimated from the training set and the ML (maximum likelihood) prior probabilities, which are 0.5. In the work of Zarit et all [13], the authors do a comparative study between the two techniques and obtain the best results with the ML technique. In each of the 4 color spaces, we used Bayes’s classification algorithm with the two techniques, utilizing the skin and non-skin probability distribution functions, which were determined from the training set. A pixel $c$ is classified as skin if relation 3 is satisfied:

$$P(skin|c) \geq P(non-skin|c)$$

Besides the images containing nuances of skin and non-skin from the training set, we also took, in the same set, images with a complex background in order to determine the segmentation threshold. Thus, after the determination of the likelihood images, in which the skin pixels have a lighter color and the non-skin pixels are black, we determined the optimal segmentation threshold. The model that will be applied to the test images is formed of the skin and non-skin distribution and probability functions, the prior probabilities and the segmentation threshold. We analyzed the obtained results from the perspective of the histogram size (number of color nuances considered on the channel). Too few bins results in poor accuracy, while too
many bins lead to over-fitting. The obtained results are illustrated in Table 1:

Table 1. Bayesian classifier

<table>
<thead>
<tr>
<th>Normalized RGB space</th>
<th>MAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>ML</td>
<td></td>
</tr>
<tr>
<td>bins no.</td>
<td>TPR(%)</td>
</tr>
<tr>
<td>256x256 bins</td>
<td>76.57</td>
</tr>
<tr>
<td>128x128 bins</td>
<td>80.48</td>
</tr>
<tr>
<td>64x64 bins</td>
<td>79.02</td>
</tr>
<tr>
<td>32x32 bins</td>
<td>83.49(δ&lt;0.3)</td>
</tr>
<tr>
<td>or 87.02(δ&lt;0.2)</td>
<td>18.22</td>
</tr>
<tr>
<td>16x16 bins</td>
<td>79.74</td>
</tr>
</tbody>
</table>

| CIE Lab              |     |
| ML                   |     |
| bins no.             | TPR(%) | FPT(%) | TPR(%) | FPR(%) |
| 256x256 bins         | 70.15  | 28.49  | 69.14  | 27.72  |
| 128x128 bins         | 73.56  | 24.56  | 73.72  | 25.61  |
| 64x64 bins           | 78.63  | 22.22  | 77.01  | 18.83  |
| 32x32 bins           | 82.16  | 17.12  | 83.72  | 22.88  |
| or 87.02(δ<0.2)      | 18.22  |         |        |        |
| 16x16 bins           | 79.55  | 19.26  | 79.55  | 19.25  |

| YCbCr                |     |
| ML                   |     |
| bins no.             | TPR(%) | FPT(%) | TPR(%) | FPR(%) |
| 256x256 bins         | 75.99  | 21.28  | 75.84  | 20.86  |
| 128x128 bins         | 81.87  | 23.59  | 81.64  | 22.59  |
| 64x64 bins           | 86.23  | 21.74  | 84.63  | 21.97  |
| 32x32 bins           | 90.81(δ<0.3) | 13.95 | 91.48  | 14.68  |
| or 83.09(δ<0.4)      | 80.14  |         | 83.77  | 8.26   |
| 16x16 bins           | 76.43  | 6.19   | 76.66  | 6.52   |

| HSV                  |     |
| ML                   |     |
| bins no.             | TPR(%) | FPT(%) | TPR(%) | FPR(%) |
| 256x256 bins         | 83.42  | 18.17  | 80.2   | 16.19  |
| 128x128 bins         | 82.9   | 17.81  | 80.23  | 17.23  |
| 64x64 bins           | 82.51  | 17.3   | 80.56  | 14.77  |
| 32x32 bins           | 84.13  | 18.5   | 74.8   | 10.72  |
| or 83.06             | 15.72  | 58.94  | 7.76   |

Analyzing the results obtained for the training set described in Section 2 we can draw the following conclusions:
- we obtained the best results with the ML technique, in which the prior probabilities are equal to 0.5;
- the lower the number of bins, the better the results, but we cannot use fewer than 32 bins because the results are poor;
- referring to the colour space used, we obtained the best results for normalized RGB and YCbCr;
- in order to reduce the number of pixels incorrectly classified, we fused the two binary images obtained in each of the normalized RGB and YCbCr spaces.

To determine the candidate face we used morphological operations and did not take into account the geometric anthropologic relations.

3.2. Skin detection using Gaussian distribution

Much of the previous work on skin classification has used a Gaussian model of skin color ([2],[1],[12],[8]). The color histogram revealed that the distribution of skin-color of different people is clustered in the chromatic color space and a skin color distribution can be represented by a Gaussian model characterised by mean and covariance:

\[
f_{pdf}(x) = p(c|skin) = \frac{1}{(2\pi)^{(d/2)}|\Sigma|^{1/2}} \exp \left( -\frac{(x-c)^T \Sigma^{-1} (x-c)}{2} \right)
\]

where:
- \(c\) – color vector
- \(\mu\) - mean of the color components of the training set
- \(\Sigma\) - covariance of the colour components of the training set

The parameters, mean and covariance, are determined for the skin and non-skin colour components:

\[
\mu = \frac{1}{n} \sum_{i} c_i, \quad \Sigma = \frac{1}{n-1} \sum_{i} (c_i - \mu)(c_i - \mu)^T
\]

where
- \(n\) = the number of images containing types of skin

The probability \(P(c|skin)\) can be used directly as a measure of the similarity with the skin color \(c\), or one can use the Mahalanobis distance between the column vectors \(c\) and the mean \(\mu\) associated to the symmetric matrix \(\Sigma^{-1}\):

\[
\lambda = (c - \mu)^T \Sigma^{-1} (c - \mu)
\]

This model was used in the works [4], [1], [13], [9]. In various color spaces the normal pdf-s depending on training dataset was determined. For the comparative study, in the case of this model, we used the same images as the ones we used in the case of the nonparametric method. To determine the optimal threshold segmentation in the model with a single Gaussian distribution function, we used images from the Compaq database which were apriorically segmented into areas of skin and non-skin. After applying this model to the test images, in the normalized RGB space, we obtained for an optimal 0.3 threshold, the positive rate TPR = 84.5% and the false positive rate FPR = 14.97%. In the CIE-Lab space TPR = 89.99%, FPR = 10.68% were obtained for an optimal 0.6 threshold. In the YCbCr space, the optimal segmentation threshold is 0.7, while the positive rate and the false positive rate are TPR = 83.18%, FPR = 15.77%, values lower than in the normalized RGB space. In the space HSV corresponding to the optimal threshold for segmentation of 0.7, we obtained the lowest values: TPR = 79.34%, FPR = 20.71%. Analyzing the results obtained for the same set of skin images and on the same test images, we see that in normalized RGB and the CIE-Lab spaces we got the best results (figure 2)
**4. CONCLUSION AND FUTURE DEVELOPMENT**

The nonparametric Bayesian classifier method for the detection of skin pixels does not necessitate a large storage space for the model and the model is obtained in a short time; the performances depend directly on the training dataset under consideration. For the images with high brightness, with shadows or objects that contain close shades of skin colour, the results are not some of the best. Fusing the results, obtained independently with models from two color areas, the candidate faces are better identified. We must emphasize the fact that for the detection of candidate faces, we used only morphological operations, regardless of the anthropological features. In order to remove the arms or compact areas other than the face, we considered that an area of the image is face if the number of holes is at least one. In the case of the Bayesian classifier method we obtained the best results for the normalized RGB and YCbCr for 32 levels of quantization/channel, the ML technique. For each model we obtained a binary image (BW_nRGB, BW_YCbCr) by means of which we created a new binary image (BW_New) by the fusing of the two. The fusion image was defined as [17]

\[
BW_{\text{New}}(i, j) = \begin{cases} 
1, & \text{for BW}_{n\text{RGB}}(i, j) = 1 \land BW_{\text{YCbCr}}(i, j) = 1 \\
0, & \text{others}
\end{cases}
\]  

(7)

For a better view of the obtained results we have chosen a set of test images: an image with excessive illumination (figure 3), a group image (fig. 4) and one that does not contain skin areas, only pixels with shades close to that of the skin (figure 5).

![Figure 3. Excessive illumination – Bayesian classifier](image)

Candidate face detection: g) fusion h) nRGB space, i) YCbCr

![Figure 4. Group image– Bayesian classifier](image)

Candidate face detection: g) fusion h) nRGB space, i) YCbCr

![Figure 5. Non-skin area image – Bayesian classifier](image)

Candidate face detection: g) fusion h) nRGB space, i) YCbCr

Applying the model with one Gaussian distribution to a test image in various colour spaces of representation, we obtained binary images with higher or lower false positive rates, depending on the determined optimal threshold. In the case of the normalized RGB space, we achieved an optimal threshold of 0.4, in the YCbCr color space, we obtained an optimal threshold equal with 0.7, and for the HSV color space we obtained from the test images an optimal threshold equal with 0.7. In the YCbCr space, the images with high brightness have the highest classification error. In order to improve the results, we apply the fusion for the CIE-Lab and nRGB color spaces. The candidate faces are shown in figures 6 (g-i), 7 (g-i), 8 (g-i)

![Figure 6. Excessive illumination – Gaussian model](image)

Candidate face detection: g) fusion h) nRGB space, i) CIELab

![Figure 7. Group image– Gaussian model](image)

Candidate face detection: g) fusion h) nRGB space, i) CIELab

![Figure 8. Non-skin area image – Gaussian model](image)

Candidate face detection: g) fusion h) nRGB space, i) CIELab

After the fusion the results are improved.
We cannot state that the implemented nonparametric model is better than the parametric one. We can only notice that, depending on the type of image, they could be grouped together pre-processing, so that the images with high brightness could be processed with the Gaussian model, while the nonparametric fusion model would lead to better results in the case of images which contain no faces.

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Figure 7. Non-skin image - Gaussian model
THE USE OF FDS FIRE MODELLING SOFTWARE FOR EDUCATIONAL PURPOSES

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ABSTRACT: The article gives for the specialists in fire safety education, two methods to use a computer software designed for fire modelling, in educational purpose, to theoretically train the fire officers that attend building fires. The two modelled situations by using Fire Dynamic Simulator computer software, are: protection of the enclosures by descending a virtual fire curtain and the implementation of backdraft, a very destructive phenomena that manifests in fire situations. The presence of the two elements together in the same structure with the intention to use the resulted information in educational purposes, is a major advantage because both are state of the art elements in CFD fire modelling but mostly because the two cases can be interdependent in fire situations, both influencing the number of casualties and the level of material damage.

Keywords: fire modelling, fire curtain, backdraft, fire officers education

1. INTRODUCTION

Fire Dynamics Simulator (FDS) is a computational software used to predict and visualize (altogether with Smokeview) the probable evolution of fires. It uses some mathematic equations and calculates the fire characteristics depending on the input data provided by the user. Fire is a complex phenomenon which can be explained mathematically, physically, chemically, through different elements such as fluid dynamics, combustion, burning related energy exchanges such as radiation, etc. All these elements, mathematically simplified, are part of the computational core of this software. At this moment, FDS is the software tool most used by researchers all over the world to predict the fire phenomena, being validated and verified in many countries. The fire safety of a building represents a complex and very important element, being the subject of discussion for many scientists. The purpose of their studies would be finding new methods to prevent fires and also to establish possibilities to predict the fire effects. This is why all the phenomena, systems and methods connected to fire protection already have been introduced in fire behavior prediction software, by using mathematical models. Until the present moment, scientists introduced in fire behavior prediction software, systems such as: ventilation systems, active fire suppression systems, fire detection systems etc.

One can observe, though, that a rather new method used in fire safety, the fire curtain, is not the subject of any paper. Also, the backdraft phenomena implemented in FDS is seldom presented in scientific papers. That is why the present article is meant to seriously improve the information concerning these two methods, [1,3-6].

2. THE IMPLEMENTATION OF FIRE CURTAINS IN FDS

The second chapter of the paper proposes a discussion concerning the analysis from different points of view, of the following situations: the descending of a fire curtain, with the purpose to prevent the spreading of fire through radiation from a burning object to another object situated right next to the first one, within a given distance. The fire curtain would fall in the vertical plan, at the middle of the distance between the two objects, blocking this way the radiation heat flux emitted by the burning object. One analyzes the moment (the time) that the descending of the fire curtain, until it reaches the floor. The mathematical approach of the situation presented above can be found into the second chapter. Following this idea, into the same chapter is calculated the needed time, for a given situation. Subsequently the obtained value is to be used at the introduction in FDS of the fire curtain should become active. Into the article one analyzes visually the blockage of the propagation, by using two simulations: a first simulation which does not contain a fire curtain and a second one that contains a fire curtain.

2.1. Fire curtains

The automatic fire curtain (fig.1) used as a fire and smoke barrier is made from fire resistant material, wrapped around an automatic roller system; this fire curtain is descended in case of necessity. When the presence of the curtain is not necessary, it returns to the initial position into the metallic head box, [8].

![Figure 1. The components of the fire resistant curtain](image-url)
Fire and/or smoke barriers operate in case one of the following situations occurs: the fire alarm is operated, manually or automatically, or a prolonged power failure, or the detecting of a defect at the wiring equipments (fig. 2).

Because a building can fill up with smoke in just a few minutes, the active face of smoke can advance quicker than a running person. That is why in a first phase the barrier is designed to descend to a predetermined height above the floor, to limit the propagation of smoke. Once the occupants of the building are evacuated after the predetermined time in the fire evacuation plan of the building, the barrier will descend to the level of the floor, forming up to a four hour fire resistant compartment.

The anchorage system depends on the structure of the ceiling. An important element consists in realizing a fixed static resistant fire barrier above the head box. This barrier will stop the smoke and fire to “pass above” the curtain.

2.2. THE PHYSICAL MODEL

The physical model is presented in figure 3. One can see the three key elements of the research: the burning object - 1, the object subject to radiation - 2 and the fire curtain AB. The propagation through radiation can occur especially in open or high spaces where the soot contained in the smoke can be found only at height, not affecting the radiation from fire.
the ignition characteristics for the material analyzed into this paper (polyurethane foam).

Table 1. The quick brown fox jumps over the lazy dog.

<table>
<thead>
<tr>
<th>Material</th>
<th>Ignition temperature $T_{ap}$ (°C)</th>
<th>Density $\rho$ (kg/m$^3$)</th>
<th>Thermal conductivity $\lambda$ (W/m·K)</th>
<th>Specific heat $c$ (kJ/kg·K)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyurethane foam</td>
<td>280</td>
<td>20</td>
<td>0,2</td>
<td>1,0</td>
</tr>
</tbody>
</table>

The density of the incidental thermal flux through radiation from fire, at any distance from the source fire is inversely related to the horizontal separation distance ($L$), by the following:

$$q^* = \frac{\chi_r \dot{Q}}{4 \cdot \pi \cdot L^2}$$  
(3)

where $\chi_r$ is the fraction of total energy radiated, $\dot{Q}$ is the heat release rate from the fire [kW] and $L$ the radial distance from the center of the flame to the edge of the target [m].

 Generally, $\chi_r$ depends on the fuel, flame size and flame configuration and can vary from approximately 0,15 for low sooting fuels to 0,6 for high sooting fuels. For the material chosen for the study (polyurethane foam), the fraction of total energy radiated is 0,4.

The heat release rate from a fire can be determined by laboratory testing. In the absence of experimental data, the maximum heat release rate from a fire ($\dot{Q}$), is given by the following equation, [1,2]:

$$\dot{Q} = \dot{m}^* \cdot \Delta H_c \cdot A_f$$  
(4)

where $\dot{m}^*$ is the burning or mass loss rate per unit area per unit time [g/m$^2$·s], $\Delta H_c$ is the effective heat of combustion [kJ/g] and $A_f$ is the horizontal burning area of the fuel. [m$^2$].

For the chosen material (polyurethane foam), the following values were taken from the specialty literature: $\dot{m}^* = 24$ g/m$^2$·s and $\Delta H_c = 20$ kJ/g.

The fire curtain has an uniform motion, therefore one can write:

$$t_{des} = \frac{\Delta x_{A-B}}{v}$$  
(5)

where $t_{des}$ is the time needed for the fire curtain to descend from point A to point B [s], having a speed $v$ [m/s].To stop the propagation of the fire, the following condition must be met:

$$t \leq t_{ig} - t_{des}$$  
(6)

where $t$ is the limit time to initiate the descending of the curtain in time to prevent the propagation of fire and $t_{ig}$ is the time of second object ignition, as seen above.

Using the data below:

$T_c = 293,15$ °K. $A_f = 0,5$ m$^2$. $v = 0,1$ m/s, the equation (6) becomes:

$$t \leq 51s - 30s, \text{ respectively } t \leq 21s$$  
(7)

This means that in the case presented above, it is necessary to initiate the descending of the fire curtain at second 21, counted from the moment of fire occurring on the first object.

2.4. INTRODUCTION OF THE MODEL IN FDS

Two simulations are performed using the FDS software. Into the first simulation (fig. 4), one can see how, at second 40, the second object is ignited. Into the second simulation, the fire curtain is already introduced and descended. The introduction of the fire curtain is practically realized by creating obstructions, segments of the fire curtain, at different progressive moments in time.

![Figure 4. FDS simulation without fire curtain (at second 40)](image)

![Figure 5. FDS simulation with fire curtain (at second 52)](image)

These obstructions (segments of the fire curtain) appear into the simulation as a descending fire curtain; of course, all the properties provided by the distributor will have to be and implemented by the fire safety researcher. The moment showed in figure 5 is represented by the second 51 – the moment when the fire curtain is completely descended to the floor level. One can see that the propagation to the second object is not present in this simulation, because of the fact that, at second 21, according to the calculations in the previous section, was initiated the descending of the fire curtain.
3. THE IMPLEMENTATION OF BACKDRAFT IN FDS

Also, the paper contains the implementation of the backdraft phenomenon in FDS software. Limited ventilation can lead to a fire in a compartment producing fire gases containing significant proportions of partial combustion products and unburnt pyrolysis products. If they accumulate then the admission of air when an opening is made to the compartment can lead to a sudden deflagration. This deflagration moving through the compartment and out of the opening is a backdraft.

The backdraft phenomena consists in a sudden increasing of burning intensity followed by an extension of the fire which can have lethal effect on firefighter crews and saving crews caught in this spontaneous event. It is a fact that most compartment fires are burning under ventilation-controlled conditions as firefighters advance in - the fire is searching for air. Any negative pressure conditions created (ie; a vented window or door) will draw the fire towards the new air supply and if this is in front, behind or adjacent to the hose-crew then that cannot be a good thing. Also, this addition of air will cause the fire to achieve a greater rate-of-burn, increasing its heat-release-rate in a very short time, and the rate of increase in intensity is direct proportional with the duration and the ventilation degree of the room. The recognition of this under ventilated burning conditions created, as the intervention tactics that need to be adapted in these cases, must be first included in the base training program of firefighters.

Because the possibility of full scale natural experiments in this domain are limited and very often impossible to realize, a useful tool of fire dynamic modelling can be the computer fire simulation, [6,7].

3.1. VENTILATION TACTICS IN BACKDRAFT SCENARIOS MODELLED WITH FDS PROGRAM

The fire compartment type used in simulated fire scenarios is a two room apartment (a large ROOM and a small one) and an entrance hall (fig. 6).

![Figure 6. The apartment type used in fire simulation](image)

The fire compartment type used in simulated fire scenarios is a two room apartment (a large ROOM and a small one) and an entrance hall (fig. 6).

For the first 3 tests the ventilation was made through the small window of the fire compartment the difference between these 3 tests consists only in the moment of opening the room door (after 10, 7 and 5 minute from the moment the fire is initiated). Due to under-ventilation of the fire compartment the conditions of a backdraft are established.

The purpose of the above mentioned experiments was to present the possible risks for fire-fighters the moment the door of fire compartment is opened and also fire intensity after different periods of time.

![Figure 7. The rate of the heat flow for the first three of the tests](image)
One can notice that the power of a backdraft, expressed by the amount of heat release (fig. 7) or by the increasing of temperature in the low layer and upper layer of the room environment (fig. 8 and 9), grows as the fire fighting intervention is delayed.

The image shown below (fig. 10) describes best the risk of a backdraft that can occur the moment the door of the fire compartment is opened.

Other 3 simulation were mode to compare the way fire develops when the large window was opened during the whole period of time and door of the fire room was opened after 10 minute – test 9, the large window was broken after 7 minute and door of the fire room was opened after 10 minute – test 8, or when the door of the fire room was opened 7 minute after and the large window was broken 10 minute after.

We can notice (fig. 13) that the fire burning is steady when the amount of air is enough, and neither the opening of the door (test 8 and 9) modifies the burning too much.

The next simulation tests 4, 5 and 6 had as main goal to test the methods of preventing this phenomenon. During the test 5 was realized positive pressure ventilation through the entrance door, at about 2 m³/s (the fan capacity) and approximately 2 minutes before opening the room door (fig. 11). The test 4 is considered the reference test, and it's similar to test 3 during the first 10 minute, and test 6 presents the probability to repeat the phenomenon in case the entrance door stays closed even thou
The breaking of the window in test 8 doesn’t lead to an intense burning as in test 7 when the door of the fire room is opened after the same time interval, both tests being under-ventilated fires.

Test 9 presents the situation when the amount of air is sufficient to avoid completely the backdraft phenomenon. We can draw the conclusion that the actions of firefighting forces are more efficient when one suspects the existence of the backdraft conditions accomplished if the windows are broken previously the door opening. We can first open the door only if we know for sure the fire properly ventilated.

Once the door has been opened on to a compartment with an oxygen starved fire and fresh air has been allowed in, there is little which can be done to prevent a backdraft happening. It is far better to make appropriate decisions before the door is ever opened, [7].

4. CONCLUSIONS

Using a method of simplified calculations, was solved a simple case of fire propagation from an object to another, through radiation. Therefore, by using empirical obtained values[1,2], one calculated the time to ignition of the second material. To prevent the propagation of fire, one proposed the use of a fire curtain, which also needs time to complete its descending to the floor level and completely block the radiation flux between the two objects. Subtracting, the fire curtain descending time from the second object ignition time, one calculated the critical time within the fire descending must be initiated. The value, e.g. 21 seconds, was introduced into the program and one could observe a good agreement between the calculus and FDS simulation. The calculation program predicted that the second object will ignite at time \( t = 40 \) seconds. A difference of 11 seconds can be seen between the time predicted by calculus (51 seconds) and the one predicted by FDS (40 seconds), but this difference can be explained by the empirical values used to calculate the time into the simplified method, but also due to the fact that the simulation was made with a space discretization and conditions imposed by the hardware used, an ordinary desktop computer with 2000 MHz processor. A difference of 11 seconds is still a reasonable value, therefore one can conclude that FDS was verified concerning the validity of the calculations.

The fire scenarios described in the third chapter are few of the most obvious ones, which sketches the backdraft conditions, and they could be representative in adopting a proper intervention tactic is such dangerous situations. These studies can be developed further, for particular situation and by modifying the fire conditions for optimizing the firefighting intervention in given cases.

If until nowadays this danger had been exposed only theoretically to firefighters especially during their training, because there were little back drafts filmed on tape, now on FDS computer programme the backdraft can be showed and analysed its different ways of manifestation during different adopted firefighting tactics.

The article presents a method to use and introduce in FDS the descending of a fire curtain and also methods and modellings in the same program, concerning backdraft phenomena. The information can be used for the activity of fire safety specialists, with the purpose of improving the way the building and the fire protection systems reacts in fire emergency cases.

The above mentioned program and methods can be recommended to all firefighting schools that train firefighters, and they can be used in training process from general to the most particular situation, to finally confront real danger with best results.

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ABSTRACT: Interface agents are parts of computer programs that, in general, offer dedicated assistance to users with their computer-based tasks but they can be also used for teaching as presented in this paper. Most interface agents are designed to customize themselves by learning from the interaction with the user and by creating the user profile. In this paper we present an experimental model of an interface agent intended as a virtual tutor. After a brief introduction of the approached topics, the history and related work are presented in section 2. The rational and approach section describes the way in which such interface agents can be implemented by taking into account also the “digital ethics” and captology (computer/agent persuasiveness) aspects. Subsequently the next section presents a possible (still experimental) model for a virtual tutor. Conclusions and future work are closing the paper. On short, this paper aims at showing how a virtual tutor can help students in the process of learning and the benefits from this human-computer interaction.

KEYWORDS: Interface Agents, Computer Persuasiveness, Digital Ethics, Virtual Tutor, Human-Computer Interaction (HCI)

1. INTRODUCTION

In artificial intelligence, an intelligent agent is an autonomous entity which observes and acts upon an environment (i.e. it is an agent) and directs its activity towards achieving goals (i.e. it is rational) [16].

Since the agent is a new concept in the computer science, its features are still a subject of controversy. For methodological reasons, its defining features are divided into two groups (controversial and non-controversial).

The non-controversial features (relatively widely accepted) are [7]:

- **Autonomy.** They can act without anyone else’s intervention (human or agent) and have a certain degree of control upon their own actions and internal status;

- **Communication ability.** Agents usually interact with other agents (by means of an inter-agent language) and with people by means of the interface;

- **Reactivity (as a response to stimulus).** Agents must be capable to respond correctly to what they perceive from the environment (stimulus from other agents, from the users, etc.);

- **Proactivity.** Agents must demonstrate teleological behaviour and have initiative. The source of initiative lays in a good knowledge about a certain domain. The proactive characteristics cover a large area (of continuously growing intelligence) from the implementation of simple algorithms (basic knowledge) to the application of refined strategies, adapted to hostile contexts (true intelligence);

- **Continuity.** The agents are perennial. That is to say they are permanently active (launched in execution) but can have different statuses: execution, pending, suspended.

As stated in [7], the terms "pro-activeness" and reactivity are not antinomian: the first has as an antonym "the lack of intention expressed by planning" and the second "passivity". Agents are commonly able of using multiple channels of communication, including written text, speech, facial expressions, and/or body language. Agents can act autonomously to complete operations without precise directions from the user, and, potentially, they can team up with other types of software agents (this feature not being of importance in the research presented herein). Interface agents are generally some applications that are often supported by knowledge bases. More refined applications may employ artificial intelligence, machine learning, and natural language processing technologies. The paper continues with the history and related work section. The rational and approach section describes the way in which such interface agents can be implemented by taking into account also the “digital ethics” and captology (computer/agent persuasiveness) aspects; also the Belief-Desire-Intention (BDI) model is introduced in the same time. The further section presents a possible (still experimental) model for a virtual tutor and conclusions and future work complete the paper.

2. HISTORY

Only humans and some animals are capable of true emotions that may alter their beliefs, desires or intentions. Therefore, the interface agents are only able to emulate or to simulate it. The emulated emotion can help in the teaching process but because this approach is too slippery to be endeavoured only by computer scientists without the help of educational psychologists and sociologists, only some aspects will be pointed out in this paper.

The related work followed three main targets: anthropocentric interfaces, captology and pathemantic agents. The interface agents described in [1], [5] and [6] were designed for medical informatics, in [2] for orality in HCI, captology for anthropocentric systems and therapy [3], [4] and [8]. Other general aspects regarding them were presented in [9], [10] and the ethical features of the agents were covered in [11], [12] and [13].
Some mechanisms were adopted unmodified (as developed in the related work) and others were obtained by refining the existing ones. All of them proved their potential in experimental models for their initial purposes and are easily adaptable for a virtual tutor.

Other researches of the authors illustrated the necessity of anthropocentric designs (“user-pulled”) and revealed the dangers of current Information and Communication Technology (ICT) designs (“technology-pushed”). Since the gap of humanists and technologists is deepened because of insufficient innovative use of new agent-oriented technology potential, an affordable manner to “invent new Computer-Aided x” application domains was proposed in [14] as Computer-Aided Semiosis.

As stated in [14], anthropocentric approaches for interface agents became common in IT. However, despite an emerging consensus that context does matter, human factors in different environments are still ignored or undervalued. The main macro-architectural features looked-for being flexibility and user-friendliness. An immediate corollary is: anthropocentric interfaces are crucial for any applications involving intensive HCI like applications making use of interface agents. To meet the challenge, the HCI community developed methodologies for incremental anthropocentric system design. Two approaches can be observed [14]: consultative design (let decision-making power to technicians, users being simply sources of information with little or no direct influence) and cooperative design (strongly involves selected users giving them the chance to influence the final system). Anyhow, the design of truly anthropocentric systems has to be carried out by interdisciplinary teams including psychologists, teachers, software engineers, mathematicians, system analysts, and specialists of the particular fields involved.

Some principles of “anthropocentric design” are [14]:

a) work must be easy for humans, not for computers (interface complexity should be the burden of the system);
b) the shift from interacting with an instrument towards interacting with an assistant has to be acknowledged and promoted;
c) anything visible to the user regarding system behaviour or structure, excepting the interface, is useless and might become harmful;
d) the design should stimulate users in adopting new working styles and/or acquiring new skills.

3. RATIONALE AND APPROACH

There are different behavioural models for intelligent agents. One of these models is the BDI model. A BDI agent is a particular type of bounded rational software agent, imbued with particular mental attitudes [17]:

- **Beliefs** represent the informational state of the agent, in other words its beliefs about the world (including itself and other agents). Beliefs can also include inference rules, allowing forward chaining to lead to new beliefs. Using the term belief rather than knowledge recognizes that what an agent believes may not necessarily be true (and in fact may change in the future).
- **Desires** represent the motivational state of the agent. They represent objectives or situations that the agent would like to accomplish or bring about.
- **Intentions** represent the deliberative state of the agent - what the agent has chosen to do. Intentions are desires to which the agent has to some extent committed. In implemented systems, this means the agent has begun executing a plan.

For the case of the interface agent designed as a virtual tutor, this model can be adapted as follows:

- The beliefs must include the information about the subjects the student is interested in learning;
- The main desire of the virtual tutor must be to able to help the student in accomplishing his/her goals (subject understanding and learning in a pleasant way);
- The intentions must include a learning plan.

In order to be successful in tutoring a student (an user), such an agent must make use (depending on the age of the student) of the entire arsenal of a real-life tutor. Some of these methods:

- **persuasiveness** (to convince the student that learning is fun, useful, important, mandatory, etc.);
- **confidence** (the tutor must act with confidence in the presence of the student);
- **emotions** (ranging from happiness to anger, depending on the feedback it receives for the student);
- **tricks** (rewarding the student for a good answer or learning by playing interactive games);
- **confidentiality** (decency and other related notions);
- **subliminal messages** (a signal or message embedded in another medium, designed to pass below the normal limits of the human mind’s perception) [18].

To validate the ethic rigorousness in the context of using the above mentioned methods and especially for the subliminal messages, we are proposing an adapted version of an “ethical potentiometer” described in [7] and [13].

This ethical potentiometer has 5 positions (depicted in Figure 1) ranging from not using subliminal messages to using them without warning the user at the beginning of a tutoring lesson:

- **EC1**: subliminal messages are not admitted;
- **EC2**: subliminal messages are admitted (as standard messages) but the user can easily see them and eliminate them if he/she wants;
- **EC3**: the user can clearly see the messages, but cannot eliminate them;
- **EC4**: the user is warned that subliminal messages may be used but he/she can neither actively perceive them nor eliminate them;
- **EC5**: the messages are transmitted subliminally (without user knowing or acceptance).

![Figure 1. Ethical Potentiometer (adapted from [7])](image-url)
A tutoring interface agent can make use of subliminal messages for some (hopefully) exceptional cases when dealing with difficult learners (e.g. undergraduates), totally unmotivated students or students with learning disabilities. Moreover, like the rest of nature, humans are multimodal (i.e., they use a blend of concurrent communication means based on at least two of the main interaction channels: visual, auditory, and haptic). Whilst nature was multimodal from the very beginning, ICTs become so too (multimodal communication becoming affordable). Hence, anthropocentric interfaces must be multimodal [14]. The best way for an interface agent to be multimodal it must have biomimetic characteristics. How else could an agent to communicate with a human as a social interactant, alive and intelligent, if it does not look alive? As presented in [7], simulating aliveness does not oblige anthropomorphism and an animated object can suggest it.

Other aspects that one should take into account when designing and modelling interface agents are regarding Daniel Dennett’s intentional stances [15]. These stances are:

- **physical** - at the level of physics and chemistry. At this level, the system is considered as a tool and for using it one should consider its structure (how does it work?)
- **design** - at the level of biology and engineering. At this level, the system is considered as a machine and for using it one should consider its utility/architecture (what it can do?)
- **intentional** - at the level of software and minds. At this level, we are concerned with things such as belief, thinking and intent; the system is considered as a person and the expectancies regarding its behaviour are based on its motivations (what does it want to do?).

Because of the fact that an interface agent designed as a virtual tutor must have biomimetic characteristics, the users (in this case, the students) will tend to regard it intentionally. This represents a plus because a human-tutor is also regarded intentionally.

### 4. EXPERIMENTAL MODEL

Since it is hard designing an interface agent from scratch, we used the Microsoft Agent Technology which has the following main advantages:

- is a quick and easy way to enhance any application;
- the agents are having numerous features including speech, animations and character movement;
- supports multiple characters on the screen at once;
- sounds and voice-recognition.

There are different types of agents designed by Microsoft (representing different metaphors – Figure 3: a magician, a robot, a genie, etc.) and others designed by other companies (Oscar the cat, Max the dog, James, Claude the bear, etc.) – Figure 4. In choosing a character suitable for a virtual tutor a more human-like appearance is preferred because it would be much more likely to be accepted as a tutor and trusted like one by a student. For this reason we used the character illustrated in Figure 5.

The experimental model was designed to assist and help students in the field of algorithms and computer programming. The application is able to:

- provide information in written and spoken form;
- interact with student while presenting the information (e.g. asks the student to provide examples);
- test and evaluate the student and based on his/her results to adopt the teaching method;

The challenge of implementing such an agent is not so much for software developers, but for methodologists and educational psychologists because of the following aspects:

- lessons must by converted/adapted from the classic style of teaching to this new approach;
- other information besides the subject matter must be included (special questions, interactive examples, etc.)
- creating an adaptive behaviour for the virtual tutor depending on the feedback received from the student.

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**Figure 2.** Intentional stances (adapted from [7])

**Figure 3.** Interface Agents designed by Microsoft

**Figure 4.** Interface agents designed by other companies
The nature of the experimental model at this point does not guarantee that it will meet the e-learning requirements. Experimental models as extended versions of the mechanisms implemented on usual computer configurations. As regards the future work, we intend to further develop other approaches and educational psychologists but – depending on the problem – also specialists from specific curricula.

In designing interfaces the leaders must be the domain experts, not the software developers. In other words, a virtual tutor agent should be designed by a transdisciplinary team guided by specialists of the application domain (first of all methodologists and educational psychologists but – depending on the problem – also specialists from specific curricula).

The nature of the experimental model at this point does not permit drawing clear cut conclusions as regards end user evaluations, but the approach based on such interfaces is in the current trends of the artificial intelligence and modern IT.

All the mechanisms proposed herein are operational and proved their efficiency in models based on multimodal intelligent interfaces using pathematic agents – as virtual therapists in medical captology as presented in the related work section.

The examples presented in this paper are not difficult to implement by software specialists and can be easily implemented on usual computer configurations.

As regards the future work, we intend to further develop other experimental models as extended versions of the mechanisms that will meet the e-learning requirements.

6. REFERENCES


THE SIMULATION METHOD AND THE INFORMATION SYSTEMS WORKING FOR EDUCATIONAL PURPOSES

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ABSTRACT: Simulation contributes to ensuring holistic educational development, coherence in the development of subsectors, and a better understanding of the implications of particular policies and strategies, by facilitating the projection of pedagogical and institutional inputs, and the financial resources which these imply. It is used to test the viability of an education policy and strategy, and to propose alternatives that can help cope with dynamic and changing environments. This article encourages our colleagues to take ownership of this tool that will help link our educational community of practice. Examples of the some most important educational data and indicators, policy options and development scenarios are explained and discussed by the authors, part from familiarization with key concepts and skills for strategic planning and simulation modelling. This research focuses on developing the necessary means to implement in the Land Forces Academy simulation methods, training-specific data structures and communication methods between a simulation, Shareable Content Object Reference Model (SCORM)-based instructional content, and a Learning Management System (LMS), to facilitate the use of simulation as an environment where an individual or a team can practice a skill (instruction) or demonstrate their level of performing the skill (performance assessment). A benefit is that the outcome of instruction can be assessed as a combination of knowledge, measured by objective testing, and performance, achieved by simulation.

1. AN OVERVIEW OF SIMULATION TECHNOLOGY

Simulation allows people to experience a variety of realistic situations and to learn from their mistakes. In general, simulation involves placing people in realistic settings for the purpose of training or performance assessment. A simulation can be "realistic" in terms of its physical and functional components, with the latter component related to the types of tasks, settings and situational factors included within the simulation.

Simulation may take many different forms, including: "live" role-play, two or three dimensional computer-based "virtual" environments (such as a flight simulator or virtual reality), computer gaming environments, and realistic video presentations. As a performance assessment medium, simulation technology has been shown to accurately and reliably diagnose performance strengths and weaknesses, thereby focusing training on areas of true need.

The biggest challenge for the army was the advance of Information, Communication and Technology (ICT). Traditional tools of IT converged with communication technologies, leading to the introduction of the new terminology and yielding products that combined the two (such as mobile telephones with basic computing functions or personal digital assistants with communication capabilities). Simulation, information systems, intelligence applications, and decision-making skills have been at the forefront of military doctrine over the past decades. The soldiers of the future will fight a war using their intelligence and not sheer brute strength.

As a result, the Romanian army now needs thinking soldiers, people who are innovative and creative to fight digital warfare, something which future wars will be all about.

2. SIMULATION AS A STRATEGIC PLANNING AND MANAGEMENT TOOL

Various educational activities [1] have been developed at European and international level in response to the broad spectrum of countries undergoing different situations: socio-economic restructuring, reconstruction of education systems in a post-war or transition period, or education reform in a changing socio-economic and cultural environment. These activities include:

- Developing sustainable sector policies, strategies and programmes;
- Strengthening national capacity to prepare national educational policies and programmes;
- Facilitating national coordination for policy dialogue in order to mobilize funding sources within a sector-wide national programme framework.
- Direct technical and financial support provided in order to strengthen national leadership in EFA1 planning[2], especially in policy formulation, strategic planning and donor coordination;
- Technical support for building or strengthening national institutional capacities in the field of operational planning, project preparation, follow-up and monitoring of plan implementation, programme evaluation, educational decentralization etc.

1 EDUCATION FOR ALL

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These activities need:

- Data analysis based on a reliable information system;
- Core EFA indicators [3] generated, analyzed and projected, such as enrolments, expenditures, teachers, internal efficiency,
- learning achievement and outcomes, adult literacy rates, gender disaggregated data, etc.;
- Critical analysis of the challenges for the achievement of EFA Goals and their implications and impacts on the other sub-sectors and levels of education;
- Analysis of the current situation of educational costs and financing

The most difficult activity connected with educational data analyses is formulation of goals in the educational field. For Formulating Goals in the education field we need:

- In-depth review of economic and social development priorities and human resource situation (CDF², PRSP³)
- Prospective analysis of macro-economic frameworks and human resource development;
- Analysis of the likely evolution of the national budget;
- Analysis of the financial affordability and sustainability of proposed EFA actions with policy simulation/projections[2]
- Measures (Planned or proposed) for institutional and administrative reforms and arrangements

Education system however, is partly provoked by the problems of presentation and dissemination of statistical information. In fact, with some exceptions, the data is published in heavy statistical yearbooks, in its raw form and without any accompanying analysis. And yet, policy and decision-makers and other planning managers need clear, easy to interpret comprehensible documents, accompanied by relevant analyses on which to base their policies. [3]

In the field of educational policies and strategies, the current focus is put on strengthening national capacities to design coherent policies and credible development plans within the framework of EFA. The areas of capacity building include, among others [4]:

- Education management information systems;
- Education sector analyses and policy assessment;
- Education policy formulation;
- Policy simulation and resource projection techniques;
- Educational expenditure and finance frameworks;
- Macro-economic frameworks;
- Monitoring and evaluation mechanism;
- SWAPs and donor coordination.

A simulation model is a tool par excellence for strategic and sector-wide planning. It is used to test the viability of an education policy and strategy, and to propose alternatives that can help cope with dynamic and changing environments. Scenario planning in education is a non-predictive means of examining a variety of possible futures either for the development of the whole education system or specific issues of interest. The simulation method is widely used as a strategic planning and management tool allowing for evidence-based policy dialogue. The scenarios, designed as results of a long process of trial and error by taking into consideration the policy options, the technical feasibilities as well as the financial constraints, feed into constructive policy and social consultations about a common future. For example:

- EPSS⁴ a "generic" simulation model made available for national administrations and education specialists who wish to adapt and use it for the optimising educational process.
- EMIS⁵ software a generic tool issued to build an Education Management Information System.

3. E-MAP VIRTUAL NETWORK ON EDUCATIONAL PLANNING AND MANAGEMENT

Within the framework of UNESCO’s support to national strategies UNESCO’s Education Sector proposes a virtual network on Educational Planning and Management, called E-Map. [5] The goal of E-Map is to provide a starting point for entry into places of enlightenment, entertainment and education on the Internet. E-Map identifies high quality, broad interest World-Wide Web sites that can teach, illuminate, and inspire.

![Figure 1. The electronic educational map](image1)

E-Map uses the following criteria for World-Wide Web site selection [6]:

- It is created by an established educational to ensure the site is authoritative, up-to-date, and long lived, it must be free to use, in part or in whole.
- The site's information must be primarily in Hypertext Markup Language format (HTML) so that it can be read by users with the lowest common denominator World-Wide Web browser. (Figure 2)

![Figure 2. E-map Word Lecture Hall](image2)

E-MAP aims to:

- promote the exchange of expertise and research in educational planning and management between UNESCO and the Members States;
- create an international platform of exchange between researchers and practitioners in educational planning and management in this field;
- reinforce the institutional capacities of the Members States in the field of educational planning and management;

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2 Common Data Format a scientific data management package (known as the "CDF Library") which allows programmers and application developers to manage and manipulate scalar, vector, and multi-dimensional data array.

3 Poverty Reduction Strategy Papers are prepared by the member countries through a participatory process involving domestic stakeholders as well as external development partners, including the World Bank and International Monetary Fund.

4 Education Planning through Simulation Systems

5 Education Management Information System.
• create a directory of nationally and/or internationally known experts
• set up a directory of national, regional and international institutions offering technical assistance, training and research
• create an accessible user-space for documentary resources and methodological tools to be uploaded and downloaded for use
• build up a discussion forum promoting live dialogue through the members of this community of practice.

Examples of the some most important educational data and indicators, policy options and development scenarios are explained and discussed part from familiarization with key concepts and skills for strategic planning and simulation modelling. These contribute meaningfully to increasing the consciousness on the need for engaging in a wider capacity building in strategic planning and management across the sector and the education management system and with a view to enhancing harmonization in the context of the Romanian integration in the European Union.

4. OPEN EDUCATIONAL RESOURCES

A variety of software tools are available from OpenLearn to help you communicate with others and to rework content. Two Knowledge Mapping tools are available: Compendium for personal use offline, and Cohere for use in our web browser to have virtual meetings, and even replay and share them afterwards. LabSpace makes many different open educational resources available to as, all of which we are encouraged to take away, reuse and remix to suit your needs as an educator.

Figure 3. Lab-Space Open-Learn Website

Broadly speaking, these resources fall into the categories of ‘content’ or ‘tools’. The main types of unit are:

• Segments of current ONU courses or support materials.
  These comprise an XML-based front page providing a short description of the unit, its learning outcomes, hyperlinks to the sections of the unit and the unit’s assets (text, MP3, images etc). In these units the majority of the original third party material has been cleared and retained.
• Teaching texts from a discontinued OU course.
  Such units contain an XML-based front page providing details of the original course and a hyperlinked list of PDF versions of the majority of the texts. Third party material has been removed.
• Audiovisual material from discontinued courses.
  These units comprise an XML-based front page providing both a description and hyperlinked list of the audio or video files.
• Specially written guides.
  These guides provide details on using the tools and technologies in the Lab Space.
• Knowledge maps linked together various different resources in a visual structure.
• Public Flash Meetings created by fellow users.
• Collaborative Units. Groups of people and organizations can develop aspects of their project which will result in new open educational resources.

5. THE POWER OF SIMULATION INTO THE HANDS OF OUR WARFIGHTERS

The characteristics of modern military conflicts highlight the rising importance of having a knowledge advantage over adversaries. Every Soldier who deploys uses some type of simulation to train critical War fighting skills. We must respond quickly to critical, emerging requirements with innovative acquisition and technology solutions and put the power of simulation into the hands of our Warfighters!

Figure 4. A possible motto for simulation research and tools

Simulation has been used for many years to train military personnel for work in hazardous environments. Effective and safe performance in these settings requires both highly skilled individuals and a high degree of team coordination. In addition to individual competence, communication between team members and decision making becomes particularly important during the management of crisis scenarios. Over the past few years several articles have described the use of simulations, simple and computer based. The focus has largely been on the acquisition and assessment of individual technical skills, but now the role of simulations in training teams to work with a greater degree of coordination is being acknowledged. Simulations are beginning to play an important part in the training of personnel in the operating theatre. The necessity to implement simulation method end create similar environments has become obvious. Simulation must facilitate relation of Data, Information, and Knowledge to Events. (Figure 5)

Figure 5. Relation of Data, Information, Simulation and Knowledge to Events. Source: (Fernandez, 2004)
6. FACILITATE USING SIMULATION IN THE LAND FORCES CADEMY (LFA)

The following experiments facilitated using simulation in LFA.

Experiment 1: Place: LFA

Subject: Individual characteristics as a key driver to SIMULATION METHOD

The 40 items with five items scale (strongly disagree, disagree, uncertain, agree, and strongly agree) referred to course components and related to “simulation”. The respondent’s individual characteristics variables were: specialty, age, sex, length of service, academic qualification. Hypothesis from 1 to 6 focused on the associations of people variable with the variables of “planning”, “training”, “evaluating”, “applications”, “skills”, and “validating”.

Results: The results showed that H0 was substantiated in the “applications” and “skills” case. There were not significant differences in perception between students and teachers. T test results indicated no significant differences in respondents’ perceiving the four variables regardless sex. There were significant differences in perceptions of “validating”, “evaluating” based on academic background, and working experience. The last testing was made with the procedure factorial ANOVAs. The personnel with high academic background in technical field showed strong or very strong perceptions. The processing of the sample set answers showed that technology is an important driver that enables the application of simulation method (r=0.765, r=correlation coefficient).

Experiment 2: Place: LFA

Subject: Academic courses in relation to simulation method.

This questionnaire consists of 40 questions (adapted Moffett et al, 2003).

Results: Descriptive statistics were calculated for variables. Paired T-tests identified significant differences between the perceived and the actual success of Simulation Method. The perceived success attributes ranged from 2.21 to 4.2 with a group mean rating of 3.23. The highest rated application of Simulation method was “military training”, with a mean rating of 4.11. A high score obtained “technical sciences.” The most important differences in means between the perception of our personnel and the usual perception revealed by literature were shown in courses related to “management”.

Experiment 3: Place: Laboratory

Subject: Importance of using simulation method in managing knowledge.

Many officers assert that experience is more variable than scientific knowledge, aiming to the wantonness of the fire rules and simulation systems. By analyzing modern types of armed confrontation we notice a common feature: dynamism, meaning that the position of the soldiers and arsenal is permanently changing which makes that the deterministic instruments in choosing the optional strategy to be not useful. This is one of the experiments that showed the necessity of reformulating and completing fire rules, very difficult to apply in complex situations on the modern battle-field. It also sowed the difference made by using an integrated system to manage knowledge and design the solution of these problems. How do we choose the fire firing procedure? The establishment of the procedure depends on many factors: the distance to the target, the environments in which it moves (land, air, and water), the speed of the target, its type, the trajectory of the target, the arsenal used to shoot (the cadence of shooting) and eventually the weather/air conditions. Our suggestion to solve this situation is to create a table (Table 4) as the one below which is more efficient and easier to be simulated by the soldiers.

Table 1. Choosing firing procedure

<table>
<thead>
<tr>
<th>Basic Weapons</th>
<th>Distance &lt; 400</th>
<th>Distance between 400 – 800</th>
<th>Distance above &gt; 800</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High Speed</td>
<td>Low Speed</td>
<td>High Speed</td>
</tr>
<tr>
<td>Assault Rifle</td>
<td>F</td>
<td>F</td>
<td>W</td>
</tr>
<tr>
<td>Medium Machine Gun</td>
<td>W</td>
<td>F</td>
<td>W</td>
</tr>
<tr>
<td>Machine Gun</td>
<td>W</td>
<td>F</td>
<td>W</td>
</tr>
</tbody>
</table>

W – Waiting fire procedure (Single firing)  
F – Following fire procedure (Sequence firing)

The three parts target group was to use mathematical models to optimize the training for mobile targets shooting. Each part was treated with a different KM: documentation on regulations and mathematical models based on library materials, films about firing infantry weapons, and accessed lab integrated software, simulated experiences with the integrated IT support (Figure 7)
By using simulation method they could calculate correction depending on the distance and the weapon used:

**Figure 8.** Using simulation

They also had the possibility to represent the relation between variables:

**Figure 9.** Correction depending on used weapon and distance

And the following table could help them to do the initial job:

**Table 2.** Value of corrections

<table>
<thead>
<tr>
<th>Distance</th>
<th>P.m</th>
<th>P. Mtr.</th>
<th>Mtr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>0.5121</td>
<td>0.5023</td>
<td>0.4829</td>
</tr>
<tr>
<td>200</td>
<td>0.7229</td>
<td>0.7032</td>
<td>0.6645</td>
</tr>
<tr>
<td>300</td>
<td>0.9337</td>
<td>0.9042</td>
<td>0.8461</td>
</tr>
<tr>
<td>400</td>
<td>1.1445</td>
<td>1.1051</td>
<td>1.0277</td>
</tr>
<tr>
<td>500</td>
<td>1.3552</td>
<td>1.3061</td>
<td>1.2092</td>
</tr>
<tr>
<td>600</td>
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<td>1.5070</td>
<td>1.3908</td>
</tr>
<tr>
<td>700</td>
<td>1.7768</td>
<td>1.7079</td>
<td>1.5724</td>
</tr>
<tr>
<td>800</td>
<td>1.9876</td>
<td>1.9089</td>
<td>1.7539</td>
</tr>
<tr>
<td>900</td>
<td>2.1984</td>
<td>2.1098</td>
<td>1.9355</td>
</tr>
<tr>
<td>1000</td>
<td>2.4091</td>
<td>2.3108</td>
<td>2.1171</td>
</tr>
</tbody>
</table>

The authors wanted to see if optimal management of knowledge produces an efficient effect measured by the possibility to create an optimal support (to complete table 4). The controlled variable whose levels were set by us (the age of students, sex, specialisation) or independent variable (type of treatment) represent a dependent factor. The different treatments constituted different levels of the independent factor creativity taking three forms: weak, medium and strong creativity. We performed a simultaneous evaluation on three groups, maintaining the level at a maximum level of 0.5. The easiest way to calculate F was using the one-way ANOVA procedure.

In which way the learner’s creativity (motivation) depends on using simulation? In which way the learner’s creativity (motivation) depends on using simulation method?

**Figure 10.** Using ANOVA descriptive therapy

*Results:* There are differences among all three groups average (F=0.45). The difference in managing knowledge is correlated in some way to the creativity of students.

**Experiment 5:** Place: Laboratory

*Subject:* Creativity and individual characteristics

We compared the characteristics of the target groups before the experiment and after it. Some questionnaires could draw the initial situation: the image of the system among students, the problems or advantages of using it, the speed in solving problems (Figure 11, 12)

**Figure 11.** Input of data: ANOVA

**Figure 12.** Results ANOVA

Experiment 3: Place: LFA
**Subject:** Information, contents and functions of LMS to facilitate using simulation

This experiment focuses on developing the necessary means to implement in the Land Forces Academy simulation methods, training-specific data structures and communication methods between a simulation, Shareable Content Object Reference Model (SCORM)-based instructional content, and a Learning Management System (LMS), to facilitate the use of simulation as an environment where an individual or a team can practice a skill (instruction) or demonstrate their level of performing the skill (performance assessment). Questionnaires were designed to elicit general descriptions of the three concepts in the context of the interviewees’ work. “Which functions are required for LMS by highly standardized educational environment?” Which are the technical critical requirements referring to quality? “Which ICT instruments are helpful for lesson plan management, coordinating training, evaluation, accomplishing research projects goals, disseminating? Which are the necessary functions of LMS to support SIMULATION?”

**Results:** Some conclusions revealed from questionnaires are systematised in Table 4:

<table>
<thead>
<tr>
<th>Functions</th>
<th>LMS SUPPORT OF:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Distance learning</strong></td>
<td>Import html, doc, pdf, ppt, documents;</td>
</tr>
<tr>
<td></td>
<td>Restricting the access;</td>
</tr>
<tr>
<td></td>
<td>Automatic registration of users.</td>
</tr>
<tr>
<td><strong>Lesson plan management</strong></td>
<td>Creation and editing of the lesson plans;</td>
</tr>
<tr>
<td></td>
<td>Dissemination navigation functions.</td>
</tr>
<tr>
<td><strong>Knowledge evaluation</strong></td>
<td>Automatic diagnosis;</td>
</tr>
<tr>
<td></td>
<td>Progressive self-evaluation;</td>
</tr>
<tr>
<td></td>
<td>Rectifying examination.</td>
</tr>
<tr>
<td><strong>Coordinated training</strong></td>
<td>Training strategies and micro-planning;</td>
</tr>
<tr>
<td></td>
<td>Trainer-learner communication;</td>
</tr>
<tr>
<td></td>
<td>Learner – trainer online communication.</td>
</tr>
<tr>
<td><strong>Distance control</strong></td>
<td>Video/audio distance control;</td>
</tr>
<tr>
<td></td>
<td>Synchronization between the content of a master copy;</td>
</tr>
<tr>
<td></td>
<td>Interactive blackboard;</td>
</tr>
<tr>
<td></td>
<td>Light Spot Functions</td>
</tr>
<tr>
<td></td>
<td>Assessing/reporting:recording.</td>
</tr>
<tr>
<td><strong>Carrying out of the exam sessions</strong></td>
<td>Creating and editing questions;</td>
</tr>
<tr>
<td></td>
<td>Creating and editing classification criteria;</td>
</tr>
<tr>
<td></td>
<td>Classifying the question;</td>
</tr>
<tr>
<td></td>
<td>Generating random tests;</td>
</tr>
<tr>
<td></td>
<td>Creating testing sessions;</td>
</tr>
<tr>
<td></td>
<td>Testing distance learners.</td>
</tr>
<tr>
<td><strong>Asynchronous communication</strong></td>
<td>Computer Science, Modelling &amp; Simulation;</td>
</tr>
<tr>
<td></td>
<td>E-learning Technologies and solutions for the</td>
</tr>
<tr>
<td></td>
<td>Engineering Domain.</td>
</tr>
<tr>
<td><strong>Warning functions</strong></td>
<td>Warning functions that signal :</td>
</tr>
<tr>
<td></td>
<td>Learning activity registration expiring time</td>
</tr>
<tr>
<td></td>
<td>Learning activity completion expiring time</td>
</tr>
<tr>
<td><strong>Forum</strong></td>
<td>Post-training session communication;</td>
</tr>
<tr>
<td></td>
<td>Shared resources.</td>
</tr>
<tr>
<td><strong>Group training functions</strong></td>
<td>Group affiliation organization and identification;</td>
</tr>
<tr>
<td></td>
<td>Resource sharing functions;</td>
</tr>
<tr>
<td></td>
<td>Support for the synchronic group collaborative training.</td>
</tr>
</tbody>
</table>

Table 4. Improving functional requirements

All teaching skill areas and teaching modules were analysed (Figure 13) from simulation perspective and will be included in the structure of a Knowledge Management System Next step (Table 5) underlined complex interactions and correlations between “customer (student and teacher) needs” and the technical characteristics. (Table 4).

<table>
<thead>
<tr>
<th>Functional Requirements</th>
<th>IMPR</th>
<th>OVM</th>
<th>ENT</th>
<th>FRA</th>
<th>FRB</th>
<th>FRC</th>
<th>FRD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coordinated training</td>
<td>0.184</td>
<td>2</td>
<td>1</td>
<td>0.012</td>
<td>0.048</td>
<td>0.092</td>
<td>0.012</td>
</tr>
<tr>
<td>Asynchronous communication</td>
<td>0.109</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>0.028</td>
<td>0.007</td>
<td>0.007</td>
</tr>
<tr>
<td>Evaluation</td>
<td>0.047</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>0.003</td>
<td>0.003</td>
<td>0.003</td>
</tr>
<tr>
<td>Lesson plan management</td>
<td>0.026</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>0.002</td>
<td>0.002</td>
<td>0.002</td>
</tr>
<tr>
<td>Absolute Weight</td>
<td>0.366</td>
<td>0.046</td>
<td>0.060</td>
<td>0.105</td>
<td>0.025</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Functional Requirement weight</td>
<td>0.195</td>
<td>0.255</td>
<td>0.445</td>
<td>0.105</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

FRA: Enable simulation FRB: Price FRC: Flexibility FRD: Performance

7. CONCLUSIONS

Application of Simulation Method (SM) in the Romanian Military Academies is regarded as inevitable and, in the authors’ opinion is the most important strategic resource of to improve training in LFA. Hence, SM involves the management of knowledge assets, that has to do with the creation of explicit processes that enhance knowledge and learning throughout our organization, ur examples point out that simulation does not necessarily have to involve high-end (and expensive) computer platforms, such as those used to train pilots. Research has demonstrated that even low fidelity simulations can provide an effective medium for training and assessment. Our scenarios, designed as results of a long process of trial and error by taking into consideration the policy options, the technical feasibilities as well as the financial constraints, let into constructive policy and social consultations about a common future. These contribute meaningfully to increasing the consciousness on the need for engaging in a wider capacity building in strategic planning and management across the sector and the education management system and with a view to enhancing harmonization in the context of the Romanian integration in the European Union.

References
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2. *** Statement of long-term pectoral and EFA policy vision (e.g. by 2015) articulated within an overall national socio-economic development strategies;
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Links:
STUDY OF DYNAMIC SYSTEMS USING VIRTUAL INSTRUMENTATION

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ABSTRACT: Programs created in LabVIEW environment, called virtual instruments, offers multiple possibilities for building user interfaces or HMI that can be used for many applications including dynamic systems analysis. In this paper we present a virtual instrument used in the process of studying the dynamics of systems through modelling and simulation. Based on the functional structure of D.C. motor and the laws of physics and electricity under which this motor works is build the mathematical model for it. Using the mathematical model, build it in Matlab environment and included in virtual instrument like a Matlab script, in a series of simulation experiments in LabVIEW, it can notice the behaviour of the motor dynamics like angular displacement, velocity and acceleration. Same virtual instrument, through a data system acquisition, allow compare, on the front panel, the results obtained by simulation with actual measured values of these quantities.

1. INTRODUCTION

One of the most used actuator in control systems is direct current (D.C.) motor. The general output variable of this actuator can by angular speed or angular displacement motion but coupled with wheels or drums and cables, can provide translate motion. This paper proposes a state-space model of the D.C. motor build for constant flux and considering two inputs: supply voltage and resistive torque.

The three states of the resulted model are represented by angular speed, angular displacement and current supply and either of these states can be an output variable for simulation model. Consequently, the system’s model has two inputs and three outputs.

Students can use the model and the VI in the classroom to have a full realization of a D.C. motor running and also how to use the latter into a control loop. As a starter, based on a functionally structure of the D.C. motor and on the laws of physics and electricity that rule the variable magnetic flux density (separate excitation) motor’s operation, students build the mathematical model of this. Afterwards, using the mathematical model in a series of simulation experiments in LabView, the students can notice the behaviour of the motor dynamics. For that, it is necessary to build the simulation VI and students must analyze the diagram bloc of the VI to observe the component subdiagrams with adequate functionality of these.

As input signal, it’s possible to select various forms for supply voltage and/or resistive torque so that the form of the outputs above-mentioned can be observed. These forms of the output can suggest the design of the control loop or the type of the controller used. Also, for every input signal, students can observe the effect of the parameters’ variation of the D.C. motor over the outputs.

2. BUILDING THE MATHEMATICAL MODEL OF THE SYSTEM

We’ll be considered a direct current (D.C.) electric motor with separate excitation, compensating winding and commutating pole. This machine structure is presenting in figure 1, where:

\[ \begin{align*}
    v_S, i_S & \quad \text{supply voltage and current;} \\
    \mu_E, i_E & \quad \text{excitation voltage and current;} \\
    R, L & \quad \text{winding electric resistance and inductance;} \\
    \varphi(t) & \quad \text{excitation flux;} \\
    e(t) & \quad \text{back electromotive force;} \\
    \omega(t) & \quad \text{angular speed;} \\
    m(t) & \quad \text{electromagnetic torque;} \\
    r_T(t) & \quad \text{restoring torque.}
\end{align*} \]

Applying Kirchhoff voltage theorem on supply circuit we have:

\[ v_S(t) - e(t) = R \cdot i_S(t) + L \cdot \frac{di_S(t)}{dt}. \]  

(1)

Torques equilibrium equation on the axis of motor is:

\[ m(t) = m_T(t) + f_T(t) + r_T(t). \]  

(2)

where \( m_T(t) \) is motoring torque and that is dependent on moment of inertia of the rotor and \( f_T(t) \) is motor friction torque.

Now torques equilibrium equation can be writing:

\[ m(t) = J \cdot \frac{d\omega(t)}{dt} + F \cdot \omega(t) + r_T(t) \]  

(3)

Is known that electromagnetic torque is dependent on the excitation flux in excitation winding and on the supply current by armature constant \( k_T \) which in SI units (which we will use) is equal to motor constant \( k_e \) (\( k_T = k_e = k \)), i.e.:

\[ m(t) = k \cdot \varphi(t) \cdot i_S(t) \]  

(4)
and also back electromotive force is dependent on the angular speed and on the excitation flux in excitation winding by motor constant $k$, i.e.:

$$e(t) = k \cdot \varphi(t) \cdot \omega(t)$$  \hspace{1cm} (5)$$

Relations (1), (3), (4) and (5) are functionally analytical equations i.e. general mathematical model of the D.C. electrical motor.

Considering the angular displacement $\alpha(t)$ instead of angular speed $\omega(t)$ like output variable is necessary to include the relationship between these:

$$\frac{d\alpha(t)}{dt} = \omega(t)$$  \hspace{1cm} (6)$$

The D.C. motor angular speed control is achieve by two methods namely constant flux and variable flux and in this paper is considering the speed control by constant flux.

2.2. Constant flux simulation model

If the excitation flux is considering constant insert the notation:

$$k \cdot \Phi = K_m$$  \hspace{1cm} (7)$$

into general mathematical model of the D.C. electrical motor. Now it can build the mathematical in state-space form so that is possible to use it into Matlab program simulation.

Substituting equations (4) and (5) and notation (7) into equations (1) and (3) result complete model by constant flux D.C. motor, respectively:

$$\begin{align*}
\frac{di_s(t)}{dt} &= \frac{1}{L} \cdot v_s(t) - \frac{R}{L} \cdot i_s(t) - K_m \cdot \omega(t) \\
\frac{d\omega(t)}{dt} &= -\frac{F}{J} \cdot \omega(t) + \frac{K_m}{J} \cdot i_s(t) - \frac{1}{J} \cdot m_L(t)
\end{align*}$$  \hspace{1cm} (8)$$

To build the state-space model brings in this mathematical model the input, state and output vectors i.e.:

- state vector $x(t)$ whose components is represented by supply current $i_s(t)$, angular displacement $\alpha(t)$ and angular speed $\omega(t)$:
  $$x(t) = \begin{bmatrix} i_s(t) \\ \alpha(t) \\ \omega(t) \end{bmatrix}$$  \hspace{1cm} (9)$$

- input vector $u(t)$ whose components is represented by supply voltage $v_s(t)$ and load torque $m_L(t)$, i.e.:
  $$u(t) = \begin{bmatrix} v_s(t) \\ m_L(t) \end{bmatrix}$$  \hspace{1cm} (10)$$

- output vector $y(t)$ whose components we consider that is the same with state vector components so that is possible to simulate these three physical quantities.

Having these vectors is possible to write equations (8) in matrix form:

$$\begin{bmatrix} i_s(t) \\ \dot{i}_s(t) \\ \dot{\omega}(t) \end{bmatrix} = \begin{bmatrix} R & 0 & -K_m \\ \frac{1}{L} & 0 & 0 \\ 0 & 0 & -\frac{F}{J} \end{bmatrix} \begin{bmatrix} i_s(t) \\ v_s(t) \\ \omega(t) \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix} \begin{bmatrix} m_L(t) \end{bmatrix}$$  \hspace{1cm} (11)$$

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Act on systems general equations this form can write in compact form:

$$\dot{x}(t) = A \cdot x(t) + B \cdot u(t)$$  \hspace{1cm} (12)$$

where $A$ and $B$ are constants matrix:

$$A = \begin{bmatrix} R & 0 & -K_m \\ \frac{1}{L} & 0 & 0 \\ 0 & 0 & -\frac{F}{J} \end{bmatrix}$$

$$B = \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}$$  \hspace{1cm} (13)$$

Now we can use the function $lsim$ whence has the form:

$$y = lsim(A, B, C, D, v, t)$$  \hspace{1cm} (17)$$

where vector $t$ specifies the time samples for the simulation and consists of regularly spaced time samples $t$ to simulate the D.C. motor like an LTI system.

3. BUILDING THE VIRTUAL INSTRUMENT TO SIMULATE D.C. MOTOR IN LABVIEW

The front panel is the user interface of the virtual instrument (VI) and it builds with controls and indicators, which are the interactive input and output terminals. Controls simulate instrument input devices and supply data to the block diagram of the VI. Indicators simulate instrument output devices and display data that are acquires or generates.

The control panel of the VI named $simmot$ used to simulate D.C. motor are presented in figure 2.
Controls on the front panel are used for setting parameters of simulation. Thus, the user can select the shape and parameters of supply voltage and load torque while displaying their shape to the graph INPUT SIGNALS. Also, the user can set the electrical and mechanical parameters of D.C. motor.

Through the graph OUTPUT SIGNALS user can observe the time evolution of the output variable, i.e. absorbed current, speed and displacement of the DC axis.

The block diagram of the VI used to simulate D.C. motor are presented in figure 3.

![Figure 3. Bloc diagram of the simmot.vi](image)

The base element of the LabView program that is used to simulation D.C. motor working is the Matlab script node. Through this, is inserting into LabView program the matrix $A$, $B$, $C$, $D$ of the motor state-space model and the simulation function also, figure 4.

![Figure 4. Matlab script node and parameters controls](image)

The motor constructive parameters $R$, $L$, $K_m$, $F$ and $J$ represent also the model parameters and these are set by controls placed on front panel named with the same letters like mentioned parameters. For the respectively controls are chosen the steps of values corresponding to the real values of these parameters. The values set by these controls represent the inputs for script node with real data type.

Because the input vector has two components for generate the right signals are build two blocks on the front panel. These two blocks are represented in diagram block by CASE structure, each with three subdiagrams, which generates the standard signals i.e. IMPULSE, STEP and RAMP. Subdiagrams contain respectively Impulse Pattern.vi, Pulse Pattern.vi and Ramp Pattern.vi and these are shifting by corresponding controls and also from the control panel are setting the parameters like amplitude, width (given by START TIME end STOP TIME), delay (given by START TIME) using for this knob or slide control, figure 5.

![Figure 5. Generating input signals](image)

With the two arrays contain the input pattern using BUIL ARRAY node it can obtain a new array that has values arranged by rows form and represent for real system the input signals and for graphic representation of these it can use a graphic display WAVEFORM GRAPH type. Necessary form for input vector require a transpose array so that obtain a vector arranged by two columns and for realize that it can use TRANSPOSE 2D ARRAY node that rearranges the elements of 2D array such that 2D array $[i, j]$ becomes transposed array $[j, i]$. Similarly the same node it using at output of the Matlab script node because the output vector of this node must row type and must have three columns that correspond to the three output signals. The input and the output terminals of the Matlab script node corresponding to the input and output signals must be Real Matrix type.

The inputs and the outputs signals have different form and different values range too (figure 6, figure 7) so that to display using the AutoScale option of the WAVEFORM GRAPH display is necessary a selection of these signals. To do that is used INDEX ARRAY nodes on the input and on the output too.

![Figure 6. Data representation of input signals](image)
The right signal is selected setting the index input of these nodes, by corresponding push button on front panel, such as to display signal in the same with connexion this to the Matlab scrip input.

Figure 7. Data representation of output signals

To right course of the simulation program is necessary that number of samples of the vector $t$ that represent simulation time in Matlab must be the same with the number of samples of the signal generation pattern. To do that, in Matlab script, the vector $t$ that specifies the time samples for the simulation has $5/0.01+1=501$ components and is necessary that the number of samples of the Ramp Pattern must be 501, too. For Stop Time control, Relative time (seconds) for Format & Precision option is to be chosen.

4. CONCLUSIONS

The Matlab $\text{lsim}$ function simulates the (time) response of continuous or discrete linear systems to arbitrary inputs and $\text{lsim} (\text{sys}, u, t)$ produces a plot of the time response of the LTI model $\text{sys}$ to the input time history. If this function is used into a Matlab simulation program additive like Matlab scrip into a LabView program named Virtual Instrument (VI) the input $u$ can be produce by a different signal generation function in VI.

LabVIEW launches Matlab and if used the $\text{plot}(t,y)$ instruction after $\text{lsim}$ instruction into Matlab script, a new Matlab window appears, labeled Figure No. 1, that displays the graphical responses of the D.C. motor outputs. In figure 8, the similarity between both LabView and Matlab results can be observed.

Through the instrumentality of controls placed on front panel of the VI it can settings the model parameters and the input signals parameters too. For example, as shown in fig.6, where load torque has a significant value, negative values appear for displacement and speed outputs. This means that the motor axle starts spinning the other way around.

Figure 8. Data representation of output signals in LabView and Matlab

Also, because LabView is a data acquisition dominant program is possible to make comparison between data acquired from a real system and data obtained from mathematical model of this system.

This paper describes a LabVIEW/Matlab based simulator for DC motors that uses a standard set of motor modeling equations to simulate the output of DC motor for typical input signals. The simulator is important because it can be used to allow students to observe the expected output of a motor by comparing simulated to actual motor output.

5. REFERENCES

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ONLINE LABORATORY SOLUTION BASED ON INTERACTIVE WEB APPLICATION

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ABSTRACT: The main purpose of this paper is to presents a website-based online laboratory solution addressed to the student audience for Process Control Engineering subject. The modern educational concepts provide two types of solutions for Internet-based distance learning approaches: Synchronous Real-time Broadcasting and Asynchronous Course-on-Demand. The virtual laboratory described in this article belongs to the synchronous applications class. Virtual laboratory it is based on client-server architecture transmitted over a TCP/IP connection and is used within a partnership between the Petroleum-Gas University of Ploiești – Romania and the Technical University of Clausthal – Germany. Also, the laboratory is used for the training of the students from Control Engineering and Applied Informatics specialty – distance learning within the Petroleum-Gas University of Ploiești. The practice modules permit to the student’s access, from University intranet or from the Internet, to the interactive web application using a web browser. They could view the process parameter, modify them from a remote location and see the control loop reaction and the control device action. The solution respects the SOA (Solution Oriented Architecture) concept.

1. INTRODUCTION

The information technology and communications growth allowed the use of computers in the education field (especially higher education). In universities is a gradual shifting from the traditional training system to a new system based on the information and communications technologies. This process passes all the training stages like: knowledge sharing, knowledge assimilation, verification and assessment [8].

The practical activities in the e-learning context requiring experimental analysis could be done in virtual laboratories or in physical ones. The virtual laboratories are made by means of asynchronous applications. That can be carried out repeatedly and do not demand prior programming. The distance-operating of physical laboratories is made by means of synchronous applications. These need complex operations of data purchasing and command transmission.

In this context, System Oriented Architecture (SOA) concept presents more benefits. It’s well known that SOA implies modularity. Distinct functions and services, which developers make accessible over a network could communicate with each other. That concept may be used in business applications, government and military environment, or educational field. The commonly way of implementation is by build SOAs using web services standards like SOAP (Simple Object Access Protocol).

On a previous paper “Online laboratory based on web technology” presented at the 4th WSEAS/IASME International Conference on Educational Technologies (EDUTE’08) was presented the first modules of the laboratory practices [7].

In this paper we present the new modules added to online applicative part addressed to all kind of students. They could access those applications from inside of University, via local network, or from distance using Internet resources.

2. PROBLEM FORMULATION

Applicative component that can be made by laboratory work is an important component of the study of engineering field. The laboratory work can be represented by online or offline modules. The curriculum of the Process Control Engineering subject includes applicative activities that involve the experimental study of control loops and control devices.

The solution described in the article consists in the web technology development of laboratory modules that contains online and offline applications and is developed on a SOA concept.

Initial these applications weren’t built like SOA modules. The previous modules: remote experimental study of control valves, remote experimental study of a controller, remote experimental study of a flow control loop, control valve’s closure member (plug) synthesis, experimental study of a simulated feed-forward control loop and experimental study of dynamics behaviour for a simulated process, was based on website application and client-server application [7].

The new approach of the online application provides new modules for synchronous models which will be used in experimental study of feedback control loops and of some control devices. These modules will allow the distance operating of control devices in the Process Control Engineering laboratory from the Petroleum-Gas University of Ploiești.

The laboratory was redesigned in such a way that it allows the adding of new modules and applications with minimum effort.

The students will make use of WEB resources where, on the basis of a username and a password, will be able to access the papers that they should work on according to the curricula.

3. PROBLEM SOLUTION

In the “Processes Control” laboratory there are three installations which can be used to carry out a group of laboratory works which contain:
- level control, flowrate control and cascade control using as controlling element a control valve (figure 1);
- level control, flowrate control and cascade control using as controlling element a variable-frequency drive (VFD) which controls the motor of a pump (figure 2);
- pressure control using Fieldbus Foundation® protocol;
- static characteristics for level and flowrate transducers.

3.1. The DeltaV™ system

The control of these installations is integrated using the DeltaV™ distributed control system. Thus, the outputs of the transducers from the above control systems are sent to the DeltaV™ and also the commands for the controlling elements are transmitted from DeltaV™.

![Figure 1. Installation 1 scheme.](image)

Figure 1. Installation 1 scheme.

![Figure 2. Installation 2 scheme.](image)

Figure 2. Installation 2 scheme.

The DeltaV™ system is a major component of the PlantWeb Architecture from Emerson Process Management® with revolutionary results in this domain [3]. DeltaV™ successfully integrates smart field devices, elements which use HART®, FOUNDATION™ Fieldbus [4], OPC standards [5], high-speed buses, advanced control etc. The results are a better process control, a more efficient management and improved information to make a plant more competitive. The DeltaV™ system is scalable both in size and functionality [3].

The DeltaV hardware (figure 3) from the laboratory contains the following elements:
- 1 analogue inputs card (AI - with 8 channels for 4-20mA analogue inputs);
- 1 analogue outputs card (AO - with 8 channels for 4-20mA analogue outputs);
- 1 digital inputs card (DI - with 8 channels for digital inputs - 24VDC);
- 1 digital outputs card (DO - with 8 channels for digital outputs - 24VDC);
- 1 Fieldbus H1 card (with 2 ports - each port supports up to 16 digital signals);
- the carrier;
- the fieldbus power supply;
- the ProPlus station.

![Figure 3. DeltaV hardware.](image)

The DeltaV Controller is the heart of the distributed system, being a microprocessor based device used to execute the control algorithms. The controller collects and processes the data according to the user program and generates the command for the controlling elements. The commands are transmitted into the process through the output modules [1].

The input and output cards assure the communication between the controller and the field devices.

DeltaV™ ProPlus is the server station which permits the communication between operators, system engineers and the controllers.

The operator station is used for system configuration, schematic displays creation, operating and monitoring the process, creation of rapports and journals for the monitored parameter from the process, supplementary diagnose operations etc [2].

In the laboratory, the main things which the students must analyze are:
- how a feedback control system works: on manual (when the command is modified) and on automatic (when the set-points for different parameters are modified);
- how a cascade control system works;
- the influence of the controller tuning parameters on the command and implicitly on the controlled variable;
- the differences between the controlling elements based on motor speed modification and the ones based on differential pressure and also the implication of using these controlling elements from energetic point of view.
To achieve these objectives operating interfaces (human-machine interfaces) using the DeltaV software must be created (figures 4-5).

Figure 4. Operating interface for installation 1.

Figure 5. Operating interface for installation 2.

Figure 6. Faceplate for flowrate controller from installation 1.

Figures 7-8 present some trend displays associated with the flowrate control on the two installations. Here, the set-point for the flowrate was modified and the evolution of the controlled variable and the command were monitored.

Figure 8. Flowrate control on installation 2 - trend display.

Besides the local operation from the laboratory, the distributed control system can be accessed remotely using network protocols. There are two possibilities to accomplish this: first choice is the configuration of DeltaV™ Operator Stations, and the second consists in installing on the DeltaV™ server software which permits computer control from distance (remote).

3.2. Remote control for applications

To control the installations from remote location VPN software can be used: VPN Proxy, UVNC, TeamViewer etc. The software used for the computer remote control in this laboratory is UltraVNC (UVNC) [6]. It has two main components:

- the UNVC Server is installed on the computer we want to control from distance;
- the UNVC Client can be installed on any computer from which we want to control the DeltaV system, computer connected on Intranet or Internet.

Before starting the UNVC server two basic configurations are necessary to assure the server security:

- assigning the port used for remote control;
- setting the server's access password.

The password and port set on the UNVC Server are used to connect from the UNVC Clients.

If the UNVC Client runs on a computer from the local network then in the field "VNC Server" are set the server's internal IP and port using the format "ip: port" (e.g. 172.16.x.x:5915). If a connection from an external location is desired then a public IP address is required, the number of the port remaining the same (e.g. 86.76.x.x:5915). When the connection is established a window for introducing the password appears. Entering the correct password grants the access to the ProPlus Station desktop and the DeltaV system can be operated.
The remote operation of the installations implies that the operating interfaces are available and from here the students can do the following:

- starting or stopping the pumps (pressure sources);
- using DeltaV Operate application can create human-machine interfaces (operating interfaces) which can be used to operate the installations from the laboratory;
- manual control of the level, flowrate and pressure control systems (which means changes of the commands sent to the control valves or the variable-frequency drive which controls the motor of a pump);
- automatic control of the same control systems as before (which means changes of the set-points, changes of the controller’s tuning parameters etc.);
- visualization of the controlled variable, command, set-point using the trend displays in both of the above situations;
- changes of the level from the water tank and of the flowrate from the pipeline and recording of the electric current from the transducer’s output in order to obtain the static characteristics of the transducers.

In addition to this method a video system is used to visualize the influence of the commands on the control equipments (control valves, pumps etc.), thus this influence can be seen not only on the operator interface but also in the real installation. Using this approach (remote control of the installations together with a video system) can stimulate the students’ attention, increasing the credibility, especially when this method is used for abroad presentations (video-conferences).

3.3. Online laboratory visibility

The problem of online application visibility was divided in two parts. Inside university access was solved allocating private IP addresses for the IP camera and application server. The obtained static IP address has form like 172.16.x.x. The second step consisted in setting of access rule, to accept incoming requests for application server. In this way, the laboratory is visible from the university intranet.

The Internet visibility for applications resides in static routing of private IP and desired port to a public IP address. Static routes were done with Linux gateway server using iptables support and rules. The used ports are out of standard ports for security reasons. Just specific request is accepted for applications and private server. In the same time was reserved the necessary bandwidth for a strong connection.

4. CONCLUSIONS

The paper presents an extension of the capabilities of the Processes Control laboratory from the Petroleum-Gas University of Ploiesti, Romania, and to be more precise the possibilities to operate remotely the installations from the laboratory.

There are presented the control loops integrated into a distributed control system, DeltaV, which can be controlled from distance.

The application is included in category Synchronous Real-time Broadcasting and Asynchronous Course on-Demand.

Students have at their disposal a powerful instrument which can be used to analyze and operate remotely many types of simple control loops (flowrate, level, pressure), complex control loops (cascade control) and also the characteristics of some transducers can be analyzed.

In the paper are presented elements that refer to development of human-machine interfaces and some aspects regarding the visibility of the created applications.

5. REFERENCES

THE INFLUENCE OF NEW VISUAL INTERFACE DESIGN ON EDUCATION DYNAMICS

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ABSTRACT: This paper means to explore visual culture in the universal digital media machines’ both hard and soft interfaces designs with respect to the latent, fundamental desire of humans across history to practice magic. Despite the lack of stylistic influence factors, magic contributes to the nature of a culture by its magnitude and frequency; it participates in building a culture exclusively as a substance, along with other creations. Without converting mysteries, it helps organize the unknown serving as provisionнаl explanation, on the possibility of communication at a distance without prior knowledge regarding the mechanism inside the means of communication. Discussing the design trend started by Apple with their iPods, iPhones and Macs, moving to the simple yet astounding Google and then to slick, transparent, visually rich, yet simple to use operating systems look and feel: from Mac OSX to Windows Vista, this article will try to encompass modern visual culture in digital media migrating towards magic in order to better fulfil the consumer’s need to be empowered. This paper will conclude that new interface design influences the way users manipulate data within the digital world thus changing traditional educational dynamics.

1. INTRODUCTION

Following Lucian Blaga1, we can say that the Romanian spirituality is expressed in key structures of Romanian folk culture, myth and magic. In his study, "About magical thinking"2, (published in 1941 at the Royal Foundation for Literature and Art), Blaga makes a clear distinction between mythical thinking and magical thinking, admitting however that the mythical and magical way of thinking occur most often in mixed form. Magical elements enter into the composition of mythical images in varying proportions, can be reduced to zero or, conversely, may prevail. Blaga shows that, by its characteristics myth is both argument and saying, without the need for evidence. Myth is an attempt to reveal a mystery by using the imagination. Magical thinking involves the idea of a substance or magical powers, both mysterious elements. Therefore magical thinking cannot be considered to be a fully revealing attempt on mystery, but an extension of it.

The philosophical coordinates that uphold Blaga’s formulations occur through two existential modes and their corresponding categories, as organizing functions of the human spirit. According to them, the human being exists in this practical, sensitive world striving for self-preservation, but also in the mystery horizon, in order to reveal the mystery. Human existence cannot be conceived outside the horizon of mystery which is the fundamental characteristic of human being and without which we would not have made the qualitative leap from biological being to man. Existing in the horizon of mystery, man and tries to reveal it through mythic, metaphysical, religious or scientific creations. These creations of human culture can be reduced to the modeling structures and functions, i.e. the same categories mentioned above.

The categories through which man perceives the phenomenal world belong to the conscious, and those that reveal the mystery to the unconscious and are dubbed by Blaga "stylistic categories of the abyss". These guide the revealing ability of human imprinting themselves in all human cultural construction, thus designed to stimulate the creative spirit. Myth creation precedes the other creations of the human spirit and tries to reveal the mysteries of existence, using elements of fantasy without needing abstract constructs, intuition or vision (such as metaphysics, religion, science). So the myth and history, are both determined by the stylistic matrix of a man or a nation, which varies considerably by geographic area, nation or individual. Mythology and history prove to be deeply structured by the stylistic categories of the human spirit. Compared to this situation of mythical creation, magical thinking proves to be just a way of thought that uses the idea of magic in the form of power or magical substance. The Romanian philosopher thinks this is an irrational concept that involves being within the object or only within one of its parts as the force of transmitting and influencing other people or objects over large distances or great spans of time2. Therefore, the idea of magic is a mysterious idea in itself, and seeking disclosure of the mystery is only a semi-disclosure. The idea of magic does not have a visionary configuration as myth, neither the particularities of scientific constructs nor the intuition of artistic creation. It only participates in maintaining the mystery horizon. Being a stereotypical constant of the human spirit everywhere, it varies only in the dosage or with the respect to the presence / absence in the mentality of individuals or peoples. Therefore, the idea of magic is not affected by the stylistic categories of human spirit in a particular region. If disclosing the mysteries of existence through myth creation depends on both the stylistic matrix of the human spirit and the particular nature of the mystery, magical thinking is just a stereotypical disclosure of the mysteries of existence.

1 Lucian Blaga (1895-1961), philosopher, poet, translator, journalist, professor and Romanian diplomat. He taught philosophy of culture at the University of Cluj until 1948. His poetry, philosophy and drama was forbidden during the communist regime, until his death in 1962.

2 The idea was demonstrated in Frazer’s book The Golden Bough.
We understand that despite the lack of stylistic influence factors, magic contributes to the nature of a culture by its magnitude and frequency. It participates in building a culture exclusively as a substance, along with other creations. Without converting mysteries, it helps organize the unknown serving as a provisional explanation, as suggested above on the possibility of communication at a distance without prior knowledge regarding the mechanism inside the means of communication. Seeing the world in a magical perspective is also a means of creating an intimate, familiar environment based on known rules, the rules of analogy, contiguity and contrast through which magic manifests itself as a power that is mysterious, paradoxical. A magically structured world is human-friendly because through the use of magical thinking, he creates the environment and sets the grounds of its understanding according to his understanding of ancient rules. Thus, magical thinking has prestige and is archaic, but its primordiality does not mean inactuality and obsoleteness. On the contrary, it continues to influence human behaviour because of its polyvalent nature.

In his book *De modes d’existence des objects techniques*, published in 1958 in Paris, Gilbert Simondon deemed that a part of the feeling of efficiency of primitive magic has become the unconditioned faith in progress. Supporting this claim Simondon describes the slip of machinist technology towards automation, incorporating components within a closed system, a perfectly functional engine. Jean Baudrillard builds on Simondon’s demonstration trying to prove that in the modern world, any gadget has a techno-mythologic power. Baudrillard has in view the functionalist myth as a fantastic anticipation of a world where the use of objects which incorporate the effort of their construction and their use in mechanisms and control gestures presupposes the total efficiency of the gesture-sign. Baudrillard refers to the functionality of shapes and the mental dynamics connotated by the signs. The example of the lighter sanded by the sea which takes the shape of the user’s palm proves the adaptation of nature, even in shapes already culturalized (i.e. the idea of the sea playing the role of a sander), man’s most whimsical desires for which the lighter thus becomes a miraculous object.

Supporting the same ideas, Baudrillard mentions the description of American cars in Vance Oakley’s book *L’Art du gaspillage* (1962, Paris, trad/ Roland Mehl). More than a sign of consumption, the car’s wing was a sign of dazzling speed that suggests the flight of a miraculous object. In this case natural symbols signified by object signs are used as models of space (the car wings). Automation, the fluidity of function are emphasized by the signs that create a natural effect through which modernity tries to hide the practical function of things. Baudrillard shows that this was possible due to the technological evolution and the energy sources revolution and has determined the pass from the universal work gesture to the control gesture. In the relation between man and the household items, cars, lighting and heating devices and gadgets there is no need for skill or understanding of the way they work. Controlling by hand or looking in the case of the remote, the pedal, the levers, the photo-electric cell have replaced the engagement of the body or limbs in grabbing and using objects. Daily practice requires at most reflexes for a minimal intervention of the hand or of the eyes. These control gestures indicate a formal participation which manages to give the man the feeling of control and the certainty of power over objects. Moreover, Baudrillard insists on proving that we live in a world in which people no longer care about the way machines and either simple or sophisticated mechanisms work. The important thing is the belief that there are technical means of solving any practical problem, even if they way they function is still a mystery for the users.

The promotion of gadgets and other machines, insisting on their form and functionality is a demonstration of the proliferation of the myth of miraculous functioning of the world. Baudrillard thinks that the technical objects are witnesses of the passing from an animist structure in which objects are witness to human presence, to an energetic imaginary containing only the dynamic image of man, the energy of objects being more and more discrete. The author supposes that the passing to an “cybernetic imaginary the central myth of which will no longer be that of absolute functionalism, but that of the absolute interrelation of the world”. The acceleration of communication processes produces the instantaneisation of the world and of messages, information and processes strengthening the impression of mastering space, of controlling reality.

There are few specialists who had the same intuition long ago before Baudrillard. “It is possible to invent a single machine which can be used to compute any computable sequence. If this machine U is supplied with the tape on the beginning of which is written the string of quintuples separated by semicolons of some computing machine M, then U will compute the same sequence as M.” (Alan Turing, *The Undecidable*, 1936)

As visionary Alan Kay (member of the Learning Research Group at Xerox Palo Alto Research Center) envisaged in his 1977 article “Personal Dynamic Media”, due to their versatile nature, computers have become true “universal media machines”.

In 1977, Alan Kay imagined the aspect of the future Dynabooks very similar to the modern laptops.

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According to Lev Manovich, “The conceptual and technical gap which separates first room size computers used by military to calculate the shooting tables for anti-aircraft guns and crack German communication codes and contemporary small desktops and laptops used by ordinary people to hold, edit and share media is vast. The contemporary identity of a computer as a media processor took about forty years to emerge – if we count from 1949 when MIT’s Lincoln Laboratory started to work on first interactive computers to 1989 when first commercial version of Photoshop was released.” (Lev Manovich, Alan Kay’s Universal Media Machine, 2006).

2. A BRIEF HISTORY OF HUMAN-MACHINE INTERFACES

Our demonstration will follow the evolution of media machines from a visual perspective which can show the tendencies of use of the different media machines.

As technology develops, one cannot help notice the general tendency that media machines follow: simpler, slick designs with fewer colors, fewer buttons, with just a few multi-purpose controls. We will try to exemplify this process in time.

2.1. Hardware

Figure 2. Wordstar keyboard, heavy, with many buttons and indications for additional functions.

Figure 3. i.Tech Virtual Keyboard, laser projection on any surface.

2.2. Software. A Short History of Operating Systems

Figure 4. 1983: Apple Lisa

Figure 5. 1985: Microsoft Windows 1.0

Figure 6. 1987: Macintosh System 5

Figure 7. 1990: Microsoft Windows 3.0

Figure 8. 1995: Macintosh System 7.5

Figure 9. 1997: Mac OS 8

Figure 10. 2001: Microsoft Windows XP
Throughout the last two decades, operating systems which define the standard human-computer interface for each generation of computers or media machines as they have been dubbed, have undergone important transformations, both visually and conceptually. Their interfaces have become more variable through customization, more adaptable through extension and more intuitive through rich visual stimuli, more organic approaches toward data manipulation due to the size of the market sector of non-tech-savvy users. How Technology Becomes Transparent

Be it a universal media machine we keep at home on a desk, one we carry around in a bag, or one we keep in our pockets, they have changed over the last decades from bulky, difficult to operate machines, full of buttons and blinking LEDs to these comfortable and esthetic, monochrome, slick surfaces that only carry one or two once omnipresent buttons, sometimes even none. These new designs for digital media machines, both for hard and soft interfaces, show that technology is becoming transparent, completing the shift from digital technology control for IT specialists to digital media consumption for the masses.

A good example would be the evolution of operating systems. Mac OS introduced the new paradigm that treats interaction as an aesthetic and meaningful experience equally applies to both types of interfaces.

“The most dramatic example of the historical shift in how interfaces are understood is the differences in user interface design between the successive generations of the operating system (OS) used in Apple computers – OS 9 and OS X. Released in October of 1999, OS 9 was the last version of Mac OS still based on the original system which came with the first Macintosh in 1984. Its look and feel – the strict geometry of horizontal and vertical lines, the similarly restrictive palette of grays and white, simple and business-like icons – speaks of modernist design and “form follows function” ideology. It fits with grey suites, office buildings in International Style, and the whole twentieth century office culture”. (Lev Manovich, Information as an Esthetic Event, 2007)

“In OS X, the interaction with the universal information processing machine of our time – a personal computer – was redefined as explicitly aesthetic experience. This aesthetic experience became as important as the functionality (in technical terms, “usability”). The word aesthetics is commonly associated with beauty, but this is not the only meaning which is relevant here. Under OS X, user interface was aesthetized in a sense that it was now to explicitly appeal to and stimulate senses - rather than only users’ cognitive processes” (Lev Manovich, Information as an Esthetic Event, 2007)

Apple’s iPods are perhaps one of the best illustrations of technology transparency. With their cool design, the perfect blend of metal and plastic, the single multi-purpose control and hi-res mini-screen, they tend to become the modern man’s next favorite media appendage (they cannot yet compete with cell phones, but iPhones can). iPhones, though much criticized for some of their flaws, represent the advent of the new micro media machine. The touch-screen is perhaps the best sign of the completion of the shift from the traditional conception of technological gadgets as extensions, as appendages of man to everyday esthetical accessories one cannot go without (the media equivalent of the Swiss-army knife).

3. THE SUPERMODERNIST AESTHETIC OF INTERFACES

“In the case of personal information technologies, the spatial form which is simultaneously “boundless” and “undefined” and also “a safe contained, a flexible shell,” seem to me a perfect spatial metaphors for the meanings of these technologies as intended by Apple, Nokia and other progressive (i.e. attuned to lifestyle and cultural trends) technology/design companies in 2000s – mobility, flexibility, lack of predefined boundaries and limits. The last meaning, however, also happens to define a modern computer in theoretical terms – a universal simulation machine which via software can simulate unlimited number of other machines and tools and, again via software, is infinitely expandable. But how do you find a visual and/or spatial expression for such a meta-machine? This is one of the challenges of contemporary aesthetics. The supermodernist aesthetics of Apple products as designed by Ive and his team has so far been one of more successful solutions to this fundamental challenge.” (Lev Manovich, Information as an Esthetic Event, 2007)
4. TECHNOLOGY USE AND MAGIC RITUALS

Arthur C. Clarke observed that any sufficiently advanced technology is indistinguishable from magic. This statement refers to the tendencies of using simple, smart designs for smart multi-purpose interfaces.

Over the ages, people have interpreted as magic what they mistook or imagined to be their control over the order of nature by superimposing their control over ideas and thoughts as anthropologist George Frazer puts it.

The gradual shift from the necessity of understanding technology in order to use it for staying in touch with post-modern/supermodern culture, causes an important change of paradigm.

The evolution towards new, slick, multipurpose, easy-to-use interfaces, the transparency of technology in these designs caused by this change goes to prove most users wish only to use technology (namely, the universal media and communication machines) as magical items, as accessories inherent to the culture they are part of.

Developers, designers and marketers strive to gratify these wishes by creating and promoting “magical” cultural artifacts no modern individual can live without.

Having in view the fact that communication and media consumption have become the rituals which govern everyday life in the third millennium, technology users become individualized by their consumption tactics, by the way they employ media machines to develop as significant parts of society.

The magic of universal media machines allows users to express themselves creatively, to develop digitally symbiotic personalities without having to understand the underlying programming, the fief of computer science specialists – the postmodern shamans who mass-produce magical items.

5. CONCLUSIONS

This paper concludes that new interface design influences the way users manipulate data within the digital world thus changing traditional educational dynamics. The simplicity and intuitive design of the interfaces make them very useful for different educational activities. Students of all ages can manipulate PCs and gadgets for research, text-editing, creative activities (using graphic and design programs such as Corel Draw, Adobe Photoshop, Adobe Illustrator, Adobe InDesign etc). At the same time, all these help academics improve their educational methods and communication with the students.

In this context, it discusses the design trend started by Apple with their iPods, iPhones and Macs, moving to the simple yet astounding Google and then to slick, transparent, visually rich, yet simple to use operating systems look and feel, from Mac OSX to Windows Vista. Therefore, the study encompasses modern visual culture in digital media migrating towards magic in order to better fulfill the consumer’s need to be empowered. Visual culture in the universal digital media machines’ both hard and soft interfaces developed in accordance with the latent, fundamental desire of humans across history to practice magic.

6. REFERENCES:

8. Turing, Alan, The Undecidable, (1965)
LIFELEARN AND THE EUROPEAN QUALIFICATION FRAMEWORK
A KNOWLEDGEABLE EDUCATOR IS THE MOST VALUABLE ASSET

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ABSTRACT: In today’s global environment, a knowledgeable educator or employee is the most valuable asset. Continuous learning is critical to overall professional and business success. This is why it is of great importance to provide relevant, yet affordable training of high quality. The objective of the paper is to present and compare the results of training needs analysis and to identify pedagogical and project risk elements using case studies based on two international EU Leonardo da Vinci pilot projects: “Adult Educator in Company”, and the project LLP-LdV-TOI-07-FI-160815 “Transfer of innovations for training need analysis to increase quality of further vocational training in the field of children’s day care and early education”. The main common project’s objectives were: to develop an evaluation tool to transform actual and current training offered by corporate/occupational further training institutes –private and public; to improve quality of corporate/ further education to meet the needs of working life; and to establish a new European network focusing on adult/further education and training needs of all occupational groups. In both projects, the training needs were identified involving universities, educational institutions, training and consulting companies from countries across Europe.

1. AN OVERVIEW OF THE TWO PROJECTS

The point of view of the DCT project has been to examine further education of staff as a quality factor of entire services in nine member countries. Increasing the quality of further training has been the most important target.

There have been implemented two surveys: one for quality of further training and one for training need pilot analysis. The quality of further training was done through the Web-query analyzed by Text Miner method [1]. The idea was to combine quantitative and qualitative analyses to reach optimal level of training need analyses. Almost 1400 answers were recorded from the 9 participating countries. Through the survey were collected and reported opinions of the employers and employees. The survey contained different tasks and competencies included in a report used for planning further education for staff. The survey included a background variable (organization and position). The scale of answers was from 1 to 4 and there were also open questions to be answered. The working method involved three transnational research meetings (in Estonia, Finland, Romania) and meanwhile workshops using mainly on-line communication methods. The results from all countries show how difficult it is to change old manners in organizing further training. Although day care professionals want to cooperate more in depth with training organizations and they are quite satisfied in the quality of further training, they also find a lot of faults and quality mistakes which are the same year after year. These features need development in closer interaction between training institutions and working life.

The majority of respondents answered that the most satisfactory features of further training are: well-informed educators, moderate prices with experts, excited experts, not too much group work, not too much ppt-presentations, topical substance. Sources of frustration are often: mumbling experts, slow theoreticians, fumbling with ADP wires, old contents, bad indoor air, difficulties to recruit substitutes, too big groups, too far away, forgetting needs of working life, high prices, low quality and not enough interaction with working life and training institutions when planning courses, many differences between advertisements and implementation.

Professionals also wish that training institutions be in closer relationship with employers and they wish also to be asked often or sometimes about their training needs. Professionals wish reasonable criteria for quality and availability of further training on national level. Retirement of the staff and attractiveness of the branch concerns the respondents.

The overall aim of the second international project (called ADEC as an acronym of Adult Educator in Company), was to develop a training program that would satisfy the needs and requirements of today’s companies and organizations and hopefully would lead to an improvement of internal training practices and thereby to a better performance and richer working life for the trained employees.

Extensive research was carried out in 7 different European countries involving 141 large companies. The results demonstrated a strong need for training of in-house trainers in certain specific areas, mainly communication and experiential training skills and an upgrading of knowledge and skills based on more recent developments in psychological and educational research. According to results of survey which captured the opinion, companies are still using mostly traditional methods of training. They are focusing on developing specific professional ‘hard’ skills. Still, the survey indicated that companies feel a need to implement new forms of training (e.g. coaching, mentoring and project work approaches) that are focusing on developing specific soft skills [2].

The project brought together a team of leading specialists in teaching, training, psychology and education from across Europe to develop a training program for a group of trainer-trainers (trainers, who train other people to train).

One of the main messages is that people learn in different ways and process it in their own personal way. Differences in genetic make-up, environment and experiences influence the way we learn. Another important message is that people learn ‘holistically’, i.e. using far more than their cognitive rational mind to store information. Most learning, in fact, happens ‘in

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spite of the conscious mind’s relatively low processing capacity. These findings are important to establish practical guidelines on how to teach and support learning given these relatively new discoveries. The skills involve heightened linguistic awareness in order to support students far better; coaching, helping the learner to learn themselves; Mindmapping to support learning using both brain hemispheres; typologies to enable trainers to understand the diversity among their learners better and a series of innovative models for optimizing the learning process to mention a few examples.

2. THE FMEA METHOD AND ITS ADAPTATION

The FMEA method (Failure Modes and Effects Analysis) is a well known and widely used instrument within quality management systems for assessing and diminishing risks. Quality specialists have employed FMEA for a long time to resolve a very important requirement within quality management system standards regarding the need for preventive actions to address potential causes of nonconformities.

The method is based on defining three dimensions of risk management:

a) severity of impact of a potential failure,

b) probability of occurrence of a potential failure, and,

c) the probability to detect its occurrence with current controls.

d) Nowadays, there are standards that systematize the issues related to this method such as: IEC 60812:2006, SAE J1739:2002, MIL-STD-1629A NOT 3 [3].

The authors of this paper believe that FMEA is a versatile technique for risk assessment, evaluation and alleviation that can be adapted for the purpose of educational projects risk management, in the following way:

![Figure 1. Proposed algorithm for risk management](image)

According to this methodology, the standard FMEA scales have been adapted to the studied context and a sample of the results is presented below:

<table>
<thead>
<tr>
<th>Score</th>
<th>Adaptation of evaluation metric</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>Minor disruption of the implementation process. Analysis and rework are necessary. Defect is noticeable only to the project team.</td>
</tr>
<tr>
<td>5-6</td>
<td>Moderate disruption of the implementation process. One or few activities have to be completely reconsidered. Major stakeholders dissatisfied.</td>
</tr>
<tr>
<td>9-10</td>
<td>Implementation process severely affected or delayed. End-result uncertain or missing proposed targets.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Occurrence scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-4</td>
</tr>
<tr>
<td>9-10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Detectability scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
</tr>
<tr>
<td>8-9</td>
</tr>
</tbody>
</table>

The AHP (Analytical Hierarchy Process) technique is used to rank scales, by comparing each of them with the other two:

<table>
<thead>
<tr>
<th>Saaty’s scale [4] used for rating elements against each other, where:</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 = slightly more important,</td>
</tr>
<tr>
<td>4 = moderately plus more important,</td>
</tr>
</tbody>
</table>
| and the reversed imply the rating of “less important”.

The score thus obtained will used to normalize the relative weights of these scales by multiplying each of the ratings with a factor equal to the new weight (above) divided by the old weight (an equal 33.33% for each).

3. DEPLOYMENT OF THE PROPOSED APPROACH

According to the above presented methodology, we present below a sample of the risks observed during the implementation and running of this ambitious project, together with the proper assessment and management techniques (see Figure 2) that can be foreseen based on this type of analysis (table2):

![Figure 2. New ranking (weights) of the evaluation scales](image)
Table 2. Deployment of the proposed approach in the case of DCT project

<table>
<thead>
<tr>
<th>No.</th>
<th>Possible negative event</th>
<th>Consequences</th>
<th>Causes</th>
<th>Control instrument</th>
<th>S</th>
<th>O</th>
<th>D</th>
<th>Risk priority number</th>
<th>Analysis</th>
<th>Actions to be taken</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lack of participation in common scheduled synchronous WebNet meetings</td>
<td>Delayed (late) work and reports, Possible opportunities for project development not used, De-motivation of project staff</td>
<td>Complex Internet connection, Time differences between countries, Lack of training</td>
<td>Proper project set meeting schedule, Dedicated project manager</td>
<td>6</td>
<td>6</td>
<td>2</td>
<td>0.572% (33.33%)</td>
<td>Moderate to high overall score. Specific actions must be tailored to the specific problem</td>
<td>Replace the whole net meeting tool, Provide training, Provide project money for faster and better Internet connection and equipment, Motivate project team, replace synchronous meetings with asynchronous meetings (e.g. via e-mail)</td>
</tr>
<tr>
<td>2</td>
<td>Small delayed in reporting</td>
<td>Possible penalties AuditAid project disruption, Complex documention process</td>
<td>Planning meetings Internal communication committed project manager</td>
<td>0.572% (33.33%), 0.28% (33.33%), 0.143% (33.33%) = 67.5</td>
<td>Low overall score Minus investment recommended</td>
<td>Start in advance, enhance communication between project manager and team, Increase number of administrative staff involved in the project</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Lack of results during the intermediate report</td>
<td>Cut off of further financial support, Not so good management of the project</td>
<td>Giant planning</td>
<td>0.572% (33.33%), 0.28% (33.33%), 0.143% (33.33%) = 67.5</td>
<td>Medium overall score, Some investment recommended</td>
<td>Provide training in project management</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Project is result oriented and not very much outcome oriented</td>
<td>Decreased chance of sustainability after the end of the financial support given by EU</td>
<td>Heavy bureaucracy (both at national and EU level), narrow scheme, Complex procedures</td>
<td>Strategic management EU rules and regulation, financial manual</td>
<td>0.572% (33.33%), 0.28% (33.33%), 0.143% (33.33%) = 246</td>
<td>Very High overall score Commitment of resources and ideas mandatory for finding solutions</td>
<td>Provide training in project management, Increase number of administrative staff involved in the project</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The project risks identified in the second program were somehow different from those of previous program and this is due mainly to the focused and outcome oriented strategy (table 3).

The ADEC project was a EU funded project that focused on introducing a new paradigm for educational train the trainer learning - and discussed its impact on the companies’ internal training practices. The objective of the project was to realize an innovative training environment hosting a pilot course available for several EU trainers. In the project several NLP theories was also scrutinized for the purposes of identifying utility, pedagogical fundament and impact on the contemporary pedagogical training theories.

Figure 3. Deployment of the proposed approach in the case of ADEC project

<table>
<thead>
<tr>
<th>No.</th>
<th>Possible negative event</th>
<th>Consequences</th>
<th>Causes</th>
<th>Control instrument</th>
<th>S</th>
<th>O</th>
<th>D</th>
<th>Risk priority number</th>
<th>Analysis</th>
<th>Actions to be taken</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Some of the planned activities cannot take place on time</td>
<td>Increased lack of motivation in the teams</td>
<td>External factors (e.g. objective causes such as climate and bad forecasting)</td>
<td>Alternative development scenarios</td>
<td>6</td>
<td>4</td>
<td>8</td>
<td>0.572% (33.33%), 0.28% (33.33%), 0.143% (33.33%) = 119</td>
<td>Moderate to high overall score. Specific actions must be tailored to the specific problem</td>
<td>Have a contingent plan</td>
</tr>
<tr>
<td>2</td>
<td>Lack of interest and motivation on behalf of the approached companies</td>
<td>The project research and working packages could be jeopardized</td>
<td>Lack of marketing</td>
<td>Dissemination procedures</td>
<td>0.572% (33.33%), 0.28% (33.33%), 0.143% (33.33%) = 67.5</td>
<td>Moderate to high overall score. Specific actions must be customized</td>
<td>Have a marketing strategy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Some of project results jeopardized by the huge amount of paper required by EU rules</td>
<td>Delays in execution, Possible funds not used or retained</td>
<td>Heavy bureaucracy (both national and EU level)</td>
<td>EU rules and regulation, financial manual</td>
<td>0.572% (33.33%), 0.28% (33.33%), 0.143% (33.33%) = 382</td>
<td>High overall score Commitment of resources and ideas mandatory for reducing</td>
<td>Increase number of administrative staff involved in the project, Have dedicated administrative staff for projects</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. CONCLUSIONS

Transfer of knowledge has become a necessity for various field experts, specialists, leaders, managers etc. Many experts in companies without formal pedagogical or andrological qualification, taking part in the educational process, work as part-time lecturers or trainers. Proper pedagogical qualification is not required in the first place for their basic working performance. Cooperation and converging tendencies between education and economy generate even greater demands on involvement of experts from companies / institutions, working as lecturers, mentors, instructors by occasion etc. This cooperation would be better, if there were also better general conditions for gaining pedagogical or andrological qualification of these specialists.

People learn in different ways and process information in their own personal way, at their own pace and time. Therefore is important to customize training according to these observations. Identifying in a correct manner the training needs and having good planning could lead to a successful project and training.

The results from the two projects show also how difficult it is to change old manners in organizing further training.

Using the FMEA method in the two EU projects some conclusions could be drawn up.

On large projects, it is very often to encounter extra work – not specified in contract documents or deemed necessary by unforeseen conditions – and payments could be made on a force account basis [5], [6], if not agreed differently, such as lump sum or unit cost.

The two EU projects were following heavy administrative EU rules and regulations. These rules – which are still in force in our days - are most probably aimed to provide an organized frame for all projects and avoid wanted or unwanted pitfalls. However, instead of that, the bureaucracy of the EU projects make them to focus rather on results and not so much on outcomes which obviously means the end of the projects and ideas at the end of the financial support.

While people focus in obeying and fill-in the huge amount of administrative work, very little time remains for the research which actually should be the focus of the projects.

While the risk assessment of the ADEC project is mainly related to some project panning management and external factors such as the low interest of companies in some countries due to the lack of legislation and culture in life long learning.
tools, trainings and education, the DCT project have had a risk factor related to synchronous communication due mainly to technology and time differences, and delays in reporting due to planning. Both projects had to deal with the heavy bureaucracy. In these conditions important financial support and resources must be allocated to deal with these matters, especially with the administrative ones. It is not right to generalize such an analysis for all EU, because the condition terms might be different, the project planning could be different, the culture is different and organizations are different as well. However, a caution note is driven by the authors of this paper that takes into account the focus of the EU projects on the process comparing with some other non EU projects that focus on outcomes. It is also important to see that FMEA could be successfully used not only in industry but in assessing risk in educational projects as well.

5. ACKNOWLEDGEMENTS

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6. REFERENCES

HOW THE LIFELEARN CONCEPT RELATES TO THE EUROPEAN QUALIFICATIONS FRAMEWORK

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ABSTRACT: The Lifelearn project which tested the accreditation of learning done through life in a variety of contexts has been tested both in Scotland and in a number of other European contexts; primarily Germany, Estonia, and Finland. The results of the project indicated high levels of interest in this type of learning from both students and tutors alike, providing high quality and motivational learning situations. The Lifelearn project examined the new concept of Lifeplace Learning (not to be confused with lifelong learning) and the Scottish model (the original model), utilised the Scottish Credit and Qualifications Framework as a major part of the design. In line with this Scottish framework, the European concept of a qualifications framework is now progressing well and many European countries are on their way to establishing how their own national frameworks relate to the EQF. This paper will discuss the framework development but importantly will suggest how the Lifeplace Learning concept enables the framework to be utilised fully to achieve goals of including more people in education and allowing for flexible and apposite learning.

1. INTRODUCTION

The prime reason for the European Qualifications Framework is to make qualifications throughout Europe more easily understood across differing qualifications systems and thereby to promote the mobility of workers and learners between countries. It is a tool for facilitating full lifelong learning [1] and enabling us to move freely throughout the variety and complexity of national systems. One of the main purposes of the EQF, according to the European Commission [1] is however, that the framework should apply to all learning and that there should also be validation of non-formal and informal learning incorporated within it. “The EQF applies to all types of education, training and qualifications, from school education to academic, professional and vocational. The system shifts the focus from the traditional approach that emphasises ‘learning inputs’ such as the length of a learning experience, or type of institution. It also encourages lifelong learning by promoting the validation of non-formal and informal learning”. This is also a prime purpose of the Lifeplace Learning concept and our Lifeplace Learning model has been encouraging such accreditation of informal and non-formal learning for the past seven years.

We have already reported [2] that in 2002 the Scottish Enterprise and Lifelong Learning Committee indicated that the governing principles for a lifelong learning strategy should include promoting a learner-led system of education that is flexible and responsive to the needs of the individual and society and the enabling of everyone to access appropriate learning. We also have advised that we designed our Lifeplace Learning model partially around this initiative. It is also clear that the Scottish Credit and Qualifications Framework (SCQF)[3] is already well established in comparing its own national qualifications using generic level descriptors, and that the Scottish model of Lifeplace Learning utilised such level benchmarks to enable the Lifeplace Learning claimed by the students undertaking the study to be accredited. Whilst the SCQF has 12 levels, there is work ongoing to map the Scottish levels against the EQF which has 8 levels, as other countries are also doing, so that any restrictions or limitations on participation in lifelong learning are restrictions related to issues other than those of qualifications.

2. THE EUROPEAN QUALIFICATIONS FRAMEWORK (EQF)

The EQF was passed by the European Parliament and Council in April 2008. When the mapping exercise on the relationships between the EQF and all other national qualifications frameworks is complete employers, educationalists and society in general will be able to easily compare qualifications across national boundaries. This will simplify the understanding of educational qualification levels and make it easier to transfer these across national systems bringing benefit for all. No longer will it be difficult to evaluate whether a qualification being transferred from one system to another is at the correct level or not as each qualification will already have been evaluated against the European standard. The idea is that all countries should establish equivalency benchmarks by 2010 and that by 2012 all new qualifications will automatically be linked to an EQF level. The core is that the eight reference evils will describe what a person knows understands and is able to do.

The EQF has two main principals; firstly to promote citizen’s mobility between countries and secondly to facilitate their lifelong learning and it is [4] complemented by the initiative on the validation of non-formal and informal learning in the EU’s Education and Training 2010 programme [5] cluster on Recognition of learning Outcomes. As stated there are 8 levels involved in the EQF beginning at school leaving certificates through to Doctoral level and the levels are described in terms of learning outcomes based on what the learners knows, understands and is able to do (competence).

The framework development started in 2004 and completed in 2008 after extensive consultation with member countries having been initiated from requests form such comities for transparency of qualification levels [4]. In addition to increasing mobility for learners and workers it is intended that the EQF will benefit individuals by increasing access to and participation in lifelong learning. This, it is anticipated, will
allow combinations of learning settings and sources and reduce barriers such as that between education providers e.g. higher and further education. It should also encourage the non-repeating of learning when moving between jobs, education providers and other institutions. The fact that non-formal learning can be supported by the framework is also a significant move forward although according to CEDEFOP this is not yet well developed and is developing sporadically and differently between nations [6] “Learning that takes place away from the classroom, during leisure time, in the family or at work, is increasingly seen as a resource that needs to be more systematically used. Non-formal learning is an indispensable but often invisible part of modern societies, currently operating in the shadows of formal education and training but with the capacity to play a more active role in matters such as labour relations… the current position on non-formal learning across Europe has to change”

In the recommendations of The European Qualifications Framework for Lifelong Learning [7] in recommending the establishment of the EQF recommendation 13 states: “This Recommendation should contribute to modernising education and training systems, the interrelationships of education, training and employment and building bridges between formal, non-formal and informal learning, leading also to the validation of learning outcomes acquired through experience”. Then under the recommendations for Member States (no. 4) it suggests that Member States should “use an approach based on learning outcomes when defining and describing qualifications, and promote the validation of non-formal and informal learning in accordance with the common European principles agreed in the Council conclusions of 28 May 2004, paying particular attention to those citizens most likely to be subject to unemployment or insecure forms of employment, for whom such an approach could help increase participations in lifelong learning and access to the labour market.”

As can be observed from the above how each Member State of the Union implements the non-formal/informal element into its national frameworks and qualifications methodologies is not standard or prescriptive, however in the draft conclusions from Europe on the identification and validation of non-formal and informal learning [8] there are some essential element mentioned. Firstly that there is a desire to make visible the extent and the value of this learning and that that this learning can be assessed and could (if required) be given accreditation in the form of a certificate or diploma in whatever system is developed. In addition it should be based on individual learning outcomes and there should be development of ways to officially validate non-formal learning experiences. A number of other initiatives had led to these requirements which were mentioned in the draft conclusion [8] such as the “Copenhagen Declaration (30 November 2002) and the Council Resolution (19 December 2002) on the promotion of enhanced European co-operation in vocational education and training acknowledged that priority should be given to developing a set of common principles regarding validation of non-formal and informal learning with the aim of ensuring greater comparability between approaches in different countries and at different levels.” In the same document the Joint Interim Report in 2004 is recalled which called for “the development of common European references and principles…” for the validation of non-formal and informal learning which would contribute to trust between key players and encourage reform without creating obligations.

What the draft conclusions proffer [8] is a set of common principles that are to be applied on a voluntary basis. They should serve “…the needs of the individual learner… support social integration, employability and the development and use of human resources in civic, social and economic contexts” including the needs of those who require “integration or reintegration into education and training, the labour market and society.” Commonality is felt to be important to ensure quality, trustworthiness, comparability and acceptance but despite this a variety of approaches are being taken. All are recommended to include the following:

- Individual entitlements inclosing choice, privacy voluntariness equality.
- Obligations of stakeholders: systems should be developed including quality assurance mechanisms. Guidance, counselling and information giving
- Confidence and trust: processes, procedures and criteria to be fair, transparent and underpinned by quality assurance mechanisms.
- Credibly mad legitimacy: legitimate interests and blanked participation of stakeholders. Assessment should be impartial and avoidance of conflicts of interest. Professional competence of those who carry out the assessment should be assured.

In Making Learning Visible [6] it is stated that there is “still no common European approach to the identification. Assessment and recognition of non-formal learning” although it does provide evidence of how each geographical area is taking the concept forward [9].

3. LIFEPLACE LEARNING

Chisholm and Burns [10] proposed and reported on a new learning paradigm called Lifeplace Learning (LPL) in the early 2000s. This new learning approach was intended to be highly flexible, learner-led and based in life places such as the non-paid workplace, the home and the community. Davis and Chisholm [11] [12] continued to research this paradigm during the 2000s and their work has led to a number of publications and to the establishment of LPL as a successful working concept, which has at its core, the recognition of all learning regardless of where, when or how it is achieved.

It was further reported by Chisholm and Blair [13] and Blair and Chisholm [14] that much of what has developed as theory and practice in relation to paid work-based learning had transferability to other life place environments such as the home, the community and geographical locale. They suggested that a useful way forward from the traditional perspective of learning and from the work-based development of learning would be to recognise all informal or even unintentional learning through a quality assurance system that would facilitate assessment and subsequent credit. On this basis, Blair and Chisholm took forward the LPL model where all the informal and unintentional learning could be quality assured, put through valid assessment and awarded credit where this was a desired outcome.

Harris, Chisholm and Allen [2] also suggest that “Fundamental to the development of the LPL model is the belief that the most effective learning, in terms of the development of knowledge, skills and competencies, is the recognition of the personal and professional autonomy of the individual learner...” They suggest that the recognition of this concept is missing in the traditional on-campus education of most university students where the curriculum is undertaken in a controlled environment and does not generally provide an environment where independent knowledge, skills and competencies can be developed nor where informal knowledge bases can be acknowledged.
The Lifelearn project also supported innovative methods of assessment relevant to the LPL model and traditional assessment criteria had to change to allow lifeplace learners to demonstrate their chosen learning outcomes in their own way. To date, permitting learners to negotiate assessment methods suitable to their own learning objectives, has proved to be highly effective and the project demonstrated that this could be done whilst still preserving quality assurance, validity (probably improved) and reliability (where necessary) to include employability skills, knowledge bases and competencies. The only mandatory parts of the assessment were two assignments, each worth 15% of the final mark for a given module. One assignment related to the completion of the personal module descriptor and the other related to the completion of a reflective analysis of the learner's unintended learning deriving from the studies carried out to achieve the module outcomes.

The LPL concept of learning also requires a change from the traditional lecturing role to that of using a mixture of facilitation, mentoring and coaching to support the negotiation and implementation of an individual's learning programme. A common approach was established at an early stage in the project to help learners set up goals that were congruent with what is important in their lives and to be able to capture the informal and non-formal learning that had been or was occurring.

The learning is primarily learner-led, directed, managed and assessed but there is facilitative support in the form of mentoring, coaching and facilitating to assist the learner in completing the module at the level specified. One important outcome built into the modules is that of recognising any unexpected but relevant and valuable learning consistent with the goals of the module. This is a particularly novel and important aspect of the lifeplace learning module.

While the content of some of the modules was subject specific, many of the topics related to more generic development of skills and competencies. The vast majority of the learners found the experience stimulating and enjoyed the learner-driven approach. The learners utilised both past and current experience alongside future skills requirements in completing the modules. The results to date provide conclusive evidence that lifeplace learning can be accredited, effectively assessed and credit awarded.

The LPL model developed to date offers learners of all age groups the facility to have learning in any life environment recognised, assessed and given credit which could (but need not) contribute to a qualification. The model offers an effective and sustainable way to achieve the required skills and competencies at undergraduate, postgraduate and post experience levels. Our research to date has clearly shown the value of the LPL environment approach and with around ninety students having completed LPL modules as part of an accredited negotiated degree this is adequate evidence of the effectiveness of the approach.

4. LIFEPLACE LEARNING AND THE FRAMEWORK

The Lifeplace Learning concept can be compared to the requirements from Europe on both the lifelong learning agenda and on the non-formal/informal learning debate where the two main principals of mobility and facilitation of lifelong learning can be accommodated. Harris, Chisholm and Allen [2] concluded that LPL is an enabling model of learning which supports learning in trans-disciplinary life environments,
delivering mixtures of subject-based learning, skills and general competencies which are not subject necessarily specific. They also suggest that it facilitates learning through personal and professional autonomy and that the model offers an ideal vehicle for learners, at any educational level to achieve a range of employability competencies, knowledge and skills and that facilitates informal and non-formal learning being recognised through assessment and the award of credit. They also state that the model could be utilised in a European context.

The Lifeplace Learning mode of learning appears to fulfil all of the criteria that are being encouraged by Europe in both the EQF and the Cluster on recognising informal and non-formal learning. It can be used to negate the need to repeat learning, uses learning outcomes and contributes to the modernising agenda. It is designed for the individual with the individual learners needs in mind. It is designed to be flexible and offer choice. It is quality assured using existing (although we would recommend adapted) models of quality assurance and it provides for valid and reliable (but not standardised) assessment. It allows knowledge to be gained, skills to be attained, and competences to be improved and measured. It allows all forms of learning to be articulated and then assessed using valid assessment criteria. It uses very clearly the level benchmarks criteria of the SCQF [3] which can clearly be transferred to utilising the EQF criteria.

In addition the LPL model of learning can integrate and reintegrate people into education and the job market place because it opens doors to all learners and all learning. Any learning articulation can be measured against the level benchmarks at national level which can then be measured against European levels in the same way as all qualifications should from 2012 onwards. It can also accommodate the requirement for accreditation in the form of certificate and/or diploma.

LPL works and we can prove that it does because it has been done. Students have used this to capture non-formal and informal learning and they have been awarded credit for his learning. Yes, here are further considerations to be made, and yes there has yet to be development of the concept but this can and does work and may be the answer that Europe is looking for to take forward the common approach to the recognition and accreditation of informal and non-formal learning.

5. REFERENCES


ENGINEERING EDUCATION: DENSE TEACHING FOR LIFE-LONG LEARNING

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The trouble with our times is that the future is not what it used to be.
PAUL VALERY

ABSTRACT: The paper starts from the conclusions of a paper on innovating engineering education, but it is only partially its extension, since moving from targets (“what needs innovating”) to methods (“how should be innovated”) entails a triple shift of focus: the perspective is rather academic than managerial, the echelon is rather tactical than strategic, the granularity is rather fine than coarse (however, specific – mainly debatable but crucial – Information Technology issues are dealt with in line with new paradigms in a paper to be presented in a section). After reviewing contextually the chief (but well-known) challenges (e.g., risk taking vs. continuity, technological innovation vs. academic inertia, exploration vs. exploitation) the paper investigates a less studied paradox of andragogy: how organise institutional teaching, clearly limited in both time (in line with the Bologna framework) and objectives (in line with the curricula) to meet expectations in a free, dynamic, and indistinct environment, as involved by life-long learning. The proposed solution is based on the concept of “e-maieutics”. Among the conclusions: a) Teaching focus must move from knowledge to skills. b) Educator profiles must move from teacher, to trainer, to mentor, to moderator, to catalyst.

1. INTRODUCTION

The paper is the fourth of a succession, as stated in the preceding one: “in the conceptual and temporal environment of this conference, there are five interconnected papers, corresponding somehow to five stages of a long-term endeavour” [22]. This paper starts from the conclusions of [22], but is only partially its extension, since moving from targets (“what needs innovating”) to methods (“how should be innovated”) entails a triple shift of focus: the perspective is rather academic than managerial, the echelon is rather tactical than strategic, the granularity is rather fine than coarse (however – specific – mainly debatable but crucial – Information Technology issues are dealt with in line with new paradigms in the fifth paper (to be presented in another section).

Thus, the conclusions of [22] formulated as premises are: a) Innovating engineering education (EE) is of paramount significance to any university and it becomes urgent to deal with. b) EE environments are open, uncertain, and intensely dynamic. c) EE should be based on advanced concepts like anthropocentric systems; cognitive ergonomics; life-long learning (3L). d) EE should be approached architecturally, basically holistic, top-down, and based on transdisciplinary research merging synergistically two vital strands explored before: quality management and agent-orientation.

Accordingly, the objectives are: a) To identify and investigate the main contradiction entailing difficulties in adapting to the Knowledge Society (KS). b) To delineate the profile of a “KS-end-user” of higher education services and to adjust it to EE.) c) As a result, to propose a kind of “KS-oriented learning methodology” starting from the outdated existing pedagogy. d) To explore thoroughly the intrinsic “temporal contradiction” asserted in [20] and [22], regarding the settings of teaching and of learning. e) On this groundwork, to propose an experimental model of a solution.

Since the blend of “research-and-position-paper” of the first papers is not necessary any longer, this paper is organised similarly to an applied exploratory-research paper: After reviewing related work in Section 2, the main contradiction entailing difficulties in adapting to KS is elaborated upon in Section 3, namely the impressive “speed of change” vs. the much slower “change of needs”. On this groundwork, EE can be approached delineating both the “robot-portrait-of-an-post-industrial-engineer” (Section 4) and “the long way from pedagogy to andragogy to heutagogy” (Section 5). Now, the hurdle created by the fact that teacher and learner live in different times (Section 6) can be analysed and dismantled, so that a solution based on “e-maieutics” (a concept launched in [4], sustained by a virtual Socrates (modelled in [3]), could be proposed (Section 7). Conclusions and intentions (Section 8) close the paper.

2. RELATED WORK

To be relevant, related work must be sorted out because of five reasons: a) the paper is the penultimate from a series of five; b) the undertaking is inclusive and – as regards some topics, for instance, agent-orientation applied to 3L – extends over more than eight years; c) regarding the most innovative aspects of this research, prior work of the authors has been presented already at this conference (in Section 3 “History. Merging Two Research Strands” of [22]); d) significant related work was reviewed very recently (in 2008 in [4] and in 2009 in [8]; e) the focus in [3] [4] [5] and [8] is on keywords pertaining to four of the five objectives set up above (the objective regarding the “temporal contradiction” is new, hence no directly related work was found). Accordingly, related work reviewed below is divided in four subsections, in line with the paper objectives (of course, recent papers review also work in closely related sub-domains):
a) The major contradiction between speedily advancing technology and slowly changing social needs is dealt with in [5] and the 22 papers referred to there. As regards the badly needed paradigm shift, a “lot of fundamental scientific concepts – inside and outside IT – changed dramatically their intension since IT begun to be the dominant “Novum Organon” of post-industrial technological development. [...] The paradigm shift “from Kelvin to Zadeh” becomes urgent to keep pace with a rapidly changing e-world” [8].

b) The key concept for profiling any end-user of education services within KS is obviously e-learning as method and – less obviously – bounded rationality as content restriction. Current e-learning is largely based on Learning Objects Repositories (LORs): “a digital object that is used in order to achieve the desired learning outcomes or educational objectives [...] Although the term, “learning object” originated from the notion of “object-oriented” computing and programming, which suggests that ideal way to build a computer program or anything digital is to assemble it from standardized, small, interchangeable chunks of code, the approach is somewhat different in an e-learning setting. In this case, learning management systems […] could be considered large meta-objects, that contain spaces for the incorporation of granular objects […]. Large repositories of learning objects are now available […]. Although this tactic offers greater access and availability, they are not always easily navigated, nor is there a uniform system for classifying them” [28].

Similar ideas about the problems of LORs: “the combination of prior knowledge analysis and a personal recommender system has a high potential to bridge the gap between the distributed resources and distributed self-directed learners who have the burden to choose suited learning activities and resources” [15], “Globalization amounts to a massive downgrading of local context and offers the prospects of an unbounded, pervasive knowledge domain. Learning, however, if it is not restricted to professional training, consists in social processes, developing in multiple formats and channels of instruction and feed-back. Such events require a given location and a specific horizon of expectations. Learning objects may become the substitutes of text books, but this does not resolve the central challenge of education: mediating abstract knowledge and embodied, contingent patterns of expertise” [13], “Change in the area of distance learning is rapid, and without a solid connection with underlying learning theories, the use of learning objects quickly becomes a function of the technology rather than the desired learning outcome” [28].

An essential work for this paper is [7], where the following quotations come from: “E-learning will be considered any pedagogy (andragogy) that utilizes the Internet for communication”. “E-learning should not be confused with distance education. Distance education is a program format in which the learners and instructors are geographically separate. While E-learning can be used in this format, it can also be used in an onsite program. Some programs allow learners the flexibility of moving in and out of LORs” [7], distance education and E-learning through out their academic career”. “Another form of E-learning is independent study”. “The main theoretical bases upon which E-learning revolves are andragogy and constructivism. Andragogy is a term that refers to the teaching methodology that best facilitates learning in the adult. Constructivism refers to the belief that learning occurs as a result of the learner thinking about and interacting with the subject matter”. Another recent comment in a specialised journal: “In the modern knowledge-intensive era, life-long competence development has become a major challenge to our educational systems that have not changed their educational policies and pedagogical models to support life-long learning. There is an increasing demand for new approaches towards fostering life-long learning perspectives” [16].

Such methods are criticised mildly in [24]: “While institutions are recognizing the value of online education, perceptions have been slower to change. Unfortunately, [...] poor attempts at online education have sometimes tended to engulf the learner, causing frustration and defeat. Studies indicate that nearly 85 percent of learners involved in [...] e-learning quit before finishing their program (2002)” [24]. In [3] (quoting also some comments in [13]), the evaluation is much more severe (mainly for the particular case of nursing).

As regards bounded rationality, it is comprehensively dealt with in [6], based on the determining work in [14] [17] [25] [27]. Likewise, more reviewed work will be in the fifth paper, in the context of agent-orientation applied to 3L.)

c) While work quoted above criticises e-learning as method, here is mentioned – and in Section 5 is investigated in detail – work questioning the very essence of learning: “as regards the learning process as such – prefixed with “e-” or not – the viewpoint is that human learning is best described by the information-processing approach in cognitive psychology” [4]. Thus: “Most modern information-processing theories are “learning-by-doing” theories which imply that learning would occur best with a combination of abstract instruction and concrete illustrations […] combining abstract instruction with specific concrete examples […] is better than either one alone” [1]. Moreover, “Higher order thinking is nonalgorithmic” [23] (the path of action is not fully specified in advance). Thus, even in the rather deductive and apodictic cognitive environment of college-level mathematics, non-ductive reasoning is vital: “The primary goal […] is to define the skill threshold necessary […] We have discovered two salient themes in the literature concerning what this means precisely. The first is the knowledge […]. The second theme concerns the skills and abilities […]. Abilities are attributes that affect the ability to perform a task, such as manual dexterity and inductive and deductive reasoning” [11].

“Learning is not restricted to the classroom and to formal learning inside learning institutions, it […] happens throughout life, at work, play and home. In the modern knowledge-intensive era, life-long competence development has become a major challenge to our educational systems that have not changed their educational policies and pedagogical models to support life-long learning. There is an increasing demand for new approaches towards fostering life-long learning perspectives” [16].

A very recent collection of basic papers in this field is [18]. One of them asserts [9]: “We define remote in terms of geography, culture, language and telecommunications. One might think that the growing availability of ‘open content’ would make this an easy task, however our initial trials show this to be incorrect. Many of the current models for open content are not flexible enough to meet the demands of supporting ‘meaningful learning’ […] In order to investigate the individual’s learning environment we undertook a very brief review of the current technology tools available on the desktop, that could assist learners in their tasks associated with personal knowledge management. There was nothing available that
offered integrated support for knowledge management within a learner's personal domain that was available for use online and offline”.

On the other hand, Aristotle is modern again: “What we have to learn to do, we learn by doing”. (Mark Twain asserted the same idea even more convincingly: “If you hold a cat by the tail you learn things you cannot learn any other way”). Indeed, “Among the processes that have been shown by recent research to have considerable power in speeding the learning process and encouraging the learner to achieve deeper levels of understanding, standing are learning from examples and learning by doing. Computer tutors, using these and other methods, are beginning to show impressive effectiveness [...] There is almost universal consensus that only the active learner is a successful learner. Proponents of situated learning and constructivism have proposed a number of modes of instruction that are aimed at encouraging initiative from students and interaction among them” [1].

d) Since the proposed solution is based on e-Maieutics, a concept defended extensively in [4] – taking advantage of the length of an invited paper – related work is mirrored in the 44 references in [4] (because the concept is still new, new concept and this undertaking as a whole is unconventional, related work propre proprio sensu does not exist; the only papers concerning it describe prior work of the authors).

3. “SPEED OF CHANGE” VS. “CHANGE OF NEEDS”

The notebook used to prepare and present this paper has a computing power 40,000 time greater than that of the Computing Centre of the Sibiu County, less than forty years ago. Perhaps the size difference between a massive medieval cathedral clock and a tiny lady wristwatch is similarly impressive but there is still a huge distinction: shrinking a clock needed almost a millennium while the “digital revolution” took less than a human lifetime. Indeed, the section title is taken from a akin section in a paper trying “to explain the widening gap between the views technologists and social scientists have about using broad-band technologies, opposing the increasing "speed of change" to the much slower "change of needs"” [5]. Section 2 of [5] is abridged below:

“Time is Money” becomes an obsolete slogan, while adapting to the overwhelming “e-rhythm” is even more difficult in the last twenty years. Among the context-related reasons: globalization, modern enterprise paradigms [...], intense (mainly positive) feedback. The main IT-related reason is “Moore’s Law” and its most vigorous consequences: Internet [...], agent technology, semantic Web, Google, and so on. [...] “Over time, the amount of transistors that could be put on a circuit for the same price doubled every 18th month! So for the same price you can buy something which can store twice as much information, every 18th month… And then doubles again in 18 months… And then doubles again in 18 months… Then the price/performance ratio doubles in 18 months… And then doubles again in 18 months! [...]” [slideshare.net/Christiansandstrom/no-technology-has-been-more-disruptive-presentation]. Moreover, this amazingly increasing computing power entails that “remembering” is almost not anymore needed, since the computer remembers much better and faster (and the “e-World” never forgets). Hence, the focus is on understanding (as aim) and on involving (as means).

On the other hand, it is unthinkable that user needs could evolve in a comparable pace. Thus, the gap between problem (real-world requirements) and solution (ICT offer) is widening because users can neither adapt nor resist to such a technological innovation rate. There are three convergent factors, supporting each other in a vicious circle manner: First, humans are inclined to reject – and even be afraid of – what they do not understand: “micro-miniaturization” (due to Moore’s law) reduces radically most perceptible effects of the digital basis of information processing (you could look into a radio, but not into an integrated circuit). Secondly, no genuine need for a “better” (more complex, smaller, faster, cheaper, etc.) tool could emerge when users were disappointed by the previous, simpler tool; though, the new ICTs will go on, proposing (or forcing) applications for rather artificial needs. Thirdly, when instead of focusing on “what feature do we need?” the problem becomes “what technology do we choose?”, the confusion is spreading and the very language/jargon impairs communication.

From a general standpoint, asserting that we are migrating towards a “civilization of illiteracy” because we entered an era of non-linear development, whereas “the experience of self-constitution in language preserves linearity”, Nadin [19] writes: “The new pragmatic framework requires skills related not only to language and literacy, but also to images, sounds, […] motion, and virtual space and time”.

In short: user’s disillusionments with technology stem – at least for the most part – from the fact that technology changes very quickly while user interests/motivations/needs change much more slowly. IT changes expressed by Moore’s Law, engender not only the huge psychological difficulty to adapt to an unprecedented speed of change but explain also some known side effects [8]: instability, complexity (mainly, cognitive), distortion, and frustration.

4. ROBOT-PORTRAIT OF AN POSTINDUSTRIAL ENGINEER

To be able to innovate here and now engineering education it is necessary to define the target: how would look like an educated engineer in the future KS. (Bizarre designations of subfields become common: after “system” and “genetic” engineering in the XXth century, now “memetic” is added too.) To boost relevance, the main features of the KS engineering profession will be stated standing out against their counterparts in customary, traditional, engineering; to emphasise the change – mostly paradigmatic shifts – the features are expressed as “From … to”. (Many of them are rephrased from [8] and will be investigated in the fifth paper.) However, why the two appellations in the title?

Postindustrial. Since KS accelerates the shift from products to services, the “postindustrial” features will be much weightier:

a) From deterministic (closed, static, known) to nondeterministic (open, dynamic, partially unknown) environment.

b) From well-defined problem (general, all-purpose, based on quantity, precision, certainty) to fuzzy-defined situation (limited, based on quality, imprecision, uncertainty).

c) From solving (atemporally) the problems (based on stability, efficiency, and reliability) to managing (“Just In Time”) the situations (based on effectiveness, flexibility and robustness).

d) From (lasting, optimal, apodictic) solutions to (temporary, suboptimal, revisable) answers.
e) From technocentric design (based on efficiency, accurate, with complex functionality) to anthropocentric design (based on value theory, user-friendly, with simple interface).

f) From conventional e-learning with programs as software entities (objects devised as tools) to innovative e-training with agents as software entities (processes devised as interactants). This major shift from photo to movie will be scrutinised in the fifth paper, from an IT perspective.

In short, it is a paradigmatic shift from the “Producer-Consumer” paradigm of the industrial era to the – much more dynamic – “Client-Server” paradigm of the postindustrial one. (It is a telling undertone in the order of the two entities: in line with the still reigning paradigm, the beneficiary is the second, whereas in the arising one, he/she is the first. Remark: in the fifth paper it will be shown that for IT even the “Client-Server” paradigm becomes obsolete.)

Robot-Portrait. There are two insinuations here: a) the target is elusive (the engineering line of work in KS is yet ethereal; its profile is “wanted”); b) the target is moving (the profile of a KS engineer is – at least – as dynamic, uncertain, and unpredictable as the working environments the engineer acts in). Whereas the features above regarded rather KS engineering as activity and challenge, the features below regard rather KS engineers as behaviour and approach.

g) From know to know-how. The (more than forty years old) lengthy shift from data-driven static knowledge towards event-driven dynamic knowledge (i.e. skills) is a corollary of the six features stated above and could be seen as the foundation any higher education in the KS (it is also a pillar of the fifth paper). The more general feature, i.e., “education in the Knowledge Society would focus rather on skills than on knowledge” [20] [22] was comprehensively dealt with in the foregoing papers. Thus, the next features are in some way particular components, adapted strategies, working examples, or a kind of “metaskills”, namely “skills to acquire skills”. In short, “how to know how”

h) From reductionist, analytic, algorithmic, apodictic reasoning to holistic, synthetic, non-algorithmic, revisable reasoning. (In other words, from solely left-brain inference chains to a blend of reasoning tactics from both brain hemispheres. Otherwise, why do we have both of them?)

i) From numeric (mathematical) precision to textual (semiotic) vagueness.

j) From building bottom-up structures based on objects to devising top-down architectures based on processes.

k) From the serenity offered by testing (based on design specifications) to the worry involved by validating (based on end-user satisfaction).

In [8] the paradigm shift is labelled as a whole: from “Kelvin-Number-Oriented” to “Zadeh-Word-Oriented”. In the fifth paper examples will be given from engineering curricula regarding mathematics, physics, chemistry, economy (based on “Just In Time” and on bounded rationality).

In short, the postindustrial engineer is immersed in a “Continuum of Learning”.

5. THE LONG WAY FROM PEDAGOGY TO ANDRAGOGY TO HEUTAGOGY

Since the three concepts are used in the title as landmarks, before examining them through the filter of their (in)adequacy to 3L, at least some simple working definitions should help, Thus pedagogy stands for children education and has its usual connotation; andragogy, is the “process of engaging adult learners in the structure of the learning experience” [en.wikipedia.org/wiki/Andragogy]; heutagogy is “the principle of teaching based upon the concept of truly self-determined learning” (http://en.wikipedia.org/wiki/Heutagogy). All three are rooted in ancient Greek education and are well known in the history of culture (examples: teaching in schools, training in battles, “learning to be old”). It seems too simplistic to mix them together, to obtain 3L; on the other hand, it is obvious that 3L is a constant of human civilization – perhaps its engine.

Pedagogy. Since it refers to children and is the oldest of the three concepts, it is the starting point to be quitted as soon as possible, to meet he requirements of 3L.

Andragogy. At first sight, andragogy seems synonym to 3L but the two terms are slightly different. “Andragogy, initially defined as "the art and science of helping adults learn," has taken on a broader meaning since Knowles' first edition. The term currently defines an alternative to pedagogy and refers to learner-focused education for people of all ages. The andragogic model asserts that five issues be considered and addressed in formal learning. They include (1) letting learners know why something is important to learn, (2) showing learners how to direct themselves through information, and (3) relating the topic to the learners' experiences. In addition, (4) people will not learn until they are ready and motivated to learn. Often this (5) requires helping them overcome inhibitions, behaviors, and beliefs about learning” [7]. Andragogy is “changing perceptions of adult learning theory and changing minds in academíá” [16].

Specific for andragogy is that: “Adult learners tend to be self-directed in their learning and desire situations in which they can control their own education. The adult learner brings certain life experiences to the classroom that should be acknowledged as a frame of reference. They also require relevance in the content being studied. The information needs to be relevant for the adult to fully appreciate the need for the learning. These characteristics result in motivation for the adult learner to continue in their academic pursuits”. “Constructivism focuses on the concept of knowledge construction versus knowledge transmission […]. The basic focus of constructivism is that the learner interacts with the content being learned. This allows the learner to develop meaning about the content being learned within an environment that is/represents reality. In essence, the learner may acquire an understanding of basic principles and concepts by examining them within their natural environment” [7].

Heutagogy. “It is suggested that heutagogy is appropriate to the needs of learners in the twenty-first century, particularly in the development of individual capability, individualised learning and independent learning using the internet-based systems including multimedia, virtual learning environments, online assessments and social software” [en.wikipedia.org/wiki/Heutagogy]. “While Malcolm Knowles contributed greatly to our understanding of the limitations of pedagogy when it came to adult learning by defining andragogy, [...] andragogy did not go far enough. Any examination of learning experiences and curricula designed around andragogical principles certainly demonstrated the capacity for linking into the adult experience and recognised the advantages of self-directed learning. However, curricula were still very much teacher-centric with little opportunity for any real involvement […] by the learner. […] Action research allows experimentation with real world
experience where learning is in the hands of the participants. […] This is as close to real world learning as one can get in a controlled setting […] doctoral students undertaking action research theses have progressed from pedagogical, then andragogical to heutagogical learning” [12]. Consequently, was this long way towards heutagogy necessary to accomplish 3L? Yes. Was it also sufficient? No, because the way is blocked by time. Indeed, it seems impossible to organise teaching, intrinsically finite in human life-time to meet the requirements of the “Continuum of Learning”, practically infinite in (active) human life-time. As always, to defeat that old and powerful enemy, which is time, we must convert it in an ally.

6. THE HURDLE: TEACHER AND LEARNER LIVE IN DIFFERENT TIMES

“Marshall McLuhan first noted the tendency to use new technologies in the model of the old. We have seen early examples (especially with remote classrooms) of teaching and learning that has hardly changed despite the investment of large sums of money and effort in new technology. Perhaps what is missing is new pedagogy that drives the development of new learning and assessment activities. In this topic we explore connectivism, heutagogy, e-Learning 2.0, and other ideas about formal and informal learning in the net-infused era” [1].

“It sounds familiar: no e-technology could solve the inherent problems of formal education, staying anchored in the old way of thinking. Worse, LORs inherited from their software objectual model the technocentric stance (focusing on “reuse”) instead of the anthropocentric one (focusing on the very “use”). This unfortunate approach can be easily proved through a Google search: “[learning objects repositories” “adult learning”] returns about 91 results, whereas replacing “adult learning” with “andragogy”, returns 9 results, and replacing it with “reuse”, returns 1060 results. Hence, the old paradigm is more than ten times stronger!” [4]. (The Google search above was made in April 2008. Repeating the search in September 2009, it returned about 304, 99, and 780 results respectively. Hence, the old paradigm is now only about 2.5 times stronger.)

Returning to the instance of “time as obstacle”, the problem is even more complex and was pointed out in the first two papers as “baffling paradox” of a “temporal contradiction”: “how to organize institutional teaching, clearly limited in both time (corresponding to the Bologna degree framework) and objectives (corresponding to the focused curricula) to meet the expectations of a dynamic and indistinct environment, as implied by the concept of life-long learning. The inconsistency is deeply rooted in traditional perceptions about the educational process itself, seen as requiring a face-to-face relationship between teacher and student. Since it is obvious that the processes of teaching and learning cannot be anymore synchronous, with the student and teacher sharing knowledge in the same space and time, a totally new […] approach is needed” [20]. Indeed, “Our present object of work (teaching) is neither present nor object, since it aims at a future, quite far away, process (learning). Why should the teacher focus on solving (predictable) problems, when the learner should focus on managing (unpredictable) situations?” [22]. Accordingly, to circumvent the hindrance, e-learning must be substituted by a method based on four ideas: a) Keep the e- (IT means are unavoidable because a lasting face-to-face relationship is out of question). b) Replace learning with “metalearning” – having the meaning of “being aware of and taking control of one’s own learning” [en.wikipedia.org/wiki/Meta_learning] (because learners are most of their life without their teachers). c) Find a way to quit the “3rd Order Ignorance” in the meaning of Armour [2]. d) Academics as educators should shift from the role of teacher to the much more subtle role of catalyst.

7. A SOLUTION: E-MAIEUTICS OR THE VIRTUAL SOCRATES

In this section title a most significant word is the article “the” because the solution proposed here –being anthropocentric and yet innovative – cannot be declared as “the solution”, since it was not validated in vivo. (As asserted in [21], “validating anthropocentric applications is done exclusively by the end-user and has three stages: in vitro (conceptual validation of the interface […]); in vivo (the interface is evaluated in detail while the functionality behind it is considered in principle); in vivo (ecological validation, i.e., in actual operation”).

The strategic decision to apply research results first only to real-world toy problems was defended in [22] (citing also [20] and [21]) “since a key thesis of the entire undertaking is affordability – in the meaning implied by the first two papers”. This approach “offers to less advanced universities the chance to “take a shortcut” (in French it sounds stronger: “brûler les étapes”), avoiding inefficient incremental research and focusing instead on exploratory, trans-disciplinary research niches for learning” [20]. In contrast, some “mechanisms […] have […] a double vulnerability: they are either incremental as regards the "Kelvin way of thinking" or too loosely linked to new paradigms. Thus, what is their relevance? To break the vicious circle – since there is no "methodology for paradigm shift “−” [8] we have to consider software to be “not a product, but rather a medium for the storage of knowledge. […] The other knowledge storage media being, in historical order: DNA, brains, hardware, and books. […] Software development is not a product-producing activity, it is a knowledge-acquiring activity” [2].

To impair redundancy with [3] [4] [5] [6] [8] [20] [21] [22] and mainly with the fifth paper, the following subtopics are here skipped: a) Practically, all “e-aspects. b) Architectural features regarding the interfaces of experimental models based on maieutical agents (for instance: nurse, disc jockey, guitar teacher). c) Skill-oriented learning (implying a fine-tuning of the shift from teacher to catalyst, mentioned above, by passing through trainer, tutor, and moderator). d) KS-oriented total quality management (above all, qualitative validation).

However, to preserve the autonomy of this paper, some key ideas are abridged below:

Maieutics revisited. After two and a half millennia Socratic maieutics is again in vogue because: a) “The activity of a teacher is relevant to the extent that it causes students to engage in activities they would not otherwise engage in” [1]. b) “One hallmark of Socratic questioning is that typically there is more than one “correct” answer, and more often, no clear answer at all. […] The Socratic method has been adapted for psychotherapy, most prominently in Classical Adlerian psychotherapy and Cognitive therapy. It can be used to clarify meaning, feeling, and consequences, as well as to gradually unfold insight, or explore alternative actions” [en.wikipedia.org/wiki/Socratic_method]. c) It is still a kind of skill-oriented metalearning. d) It is andragogical par excellence and has some heutagogical features too.
E-Maieutics. The concept was introduced in [4] “as (essentially nonalgorithmic) alternative to conventional e-Learning, suited to both content (specific to life-long learning) and setting (dynamic and uncertain environments, hosting most nontrivial interactive applications) […] where maieutics is action-oriented and highly personalised, while "e-" is carried out through virtual entities interacting with the learner as interface agents” [4]. Its two key design-space dimensions follow.

**Bounded rationality.** “The term is used as defined, explained and endorsed in [10] [25][27] […] time is gained giving up the "force of perfection". That means to acknowledge that in real-world applications, it is illusory to hope for well-defined [...] problems, complete information, accurate data, acceptable time restrictions, low risk, conventional business, etc. and for being able to give optimal solutions through scores of exact data (if possible, output offline and sequential). On the contrary, most problems are multicritical, online, and distributed, supplied with incomplete, fuzzy, and/or uncertain information – arriving in parallel, in huge amounts and in unpredictable moments –, in the context of critical response time, high risk, virtual enterprises, etc. [...] The solution must arrive “just in time” and be acceptable suboptimal” [3].

**Simon-Learning.** “Learning should be considered – in both humans and agents – as a process where most effectiveness is reached through a blend of symbolic (“left-hemisphere”-like) and subsymbolic (“right-hemisphere”-like) modi operandi. Nowdays, the approach is much closer to "by rote learning”. Thus, the balance has to be redressed, favouring right hemisphere tactic” [3]. That means that learning should be assessed holistically. Thus, the performance metrics proposed is based on action-oriented “Simon-type machine learning” [26] [1], namely, the diminishing duration of task completion (evaluated through a simple time derivative of task duration).

**Experimental models.** The design space for virtual Socratic educators was drafted [3] [4] but only some of its dimensions have been implemented in interfaces. The less primitive Socratic agent is now a virtual guitar teacher (details in the fifth paper).

### 8. CONCLUSIONS AND INTENTIONS

The conclusions match up with the paper objectives and are presented in the same order:

a) The main contradiction entailing difficulties in adapting to the KS is the widening gap between problem (real-world requirements expressed as user needs) and solution (ICT offers evolve in an amazingly fast and nonlinear pace). Users can neither adapt nor resist to such an accelerating technological innovation rate.

b) The postindustrial engineer – as “KS-end-user” of higher education services – will be immersed in a “Continuum of Learning”. Focus moves from static general knowledge to dynamic personalised knowledge. The quantity of information is replaced by the quality of skill.

c) As a result, a “KS-oriented learning methodology” was outlined based on andragogical and heutagogical principles. Educator profiles must move from teacher, to trainer, to tutor, to moderator, to catalyst.

d) Since teacher and learner could be synchronised for only short periods, it is very difficult to organise teaching, intrinsically finite in human life-time to meet the requirements of 3L, practically infinite in (active) human life-time. To explore thoroughly the intrinsic “temporal contradiction” asserted in [20] and [22], regarding the settings of teaching and of learning.

e) On the groundwork of this intrinsic “temporal contradiction”, a solution model for 3L was proposed starting from e-maieutics, an innovative concept launched in 2008, where learning is action-oriented, highly personalised, and catalysed through virtual maieuts interacting with the learner as interface agents.

**Intentions.** The keyword is affordability. Specific steps will be set up in line with the proposals for interbalkan cooperation in engineering education, presented in the third paper.

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### 9. REFERENCES


ABSTRACT: The importance of training for the work market is supported by the necessity of dealing with the rapid changes of requesting new qualifications. The transition from school to the work market is based on a basic professional formation and on learning adjusted to the requests of this market. In this respect, authors claim that employers prefer graduates with general training to academic qualifications which are very specialized as they prefer to train their new employees locally, according to the necessities of the specific job. Lifetime education must help solving some of the problems the contemporary society is confronted with. Therefore, the educational systems must function according to society needs, but they must also have a certain stability and continuity that can provide them with efficiency on the long run.

1. INTRODUCTION

In a permanently changing market economy, it is very common that people should change their jobs completely or partially at least once in a lifetime. Alvin Toffler wrote in 1970 that at the beginning of the Third Millennium, about 30% of the people employed will have to find other jobs than those which they were initially trained for. In 2006, "World Job Statistics", carried out by the UN, noted that during 1996 and 2006 over 45% of the people employed from 100 countries had to change their jobs. This is exactly the point where developed countries managed to create a new advantage thanks to coherent and consistent long-term national policies related to adult re-training. Some of the examples included the Japan, the Scandinavian countries, Germany and the Netherlands, where early practically 95-97% of the adults that had to give up their initial jobs have benefited from state budget paid re-training, as early as of the ’90s.

2. LIFELONG HUMAN CAPITAL EDUCATION AND TRAINING – VITAL NEEDS OF THE PRESENT

Lifelong human resource training, aspect that supports economic growth, means implementing the principle of “lifelong learning”. This is represented by all learning activities carried out throughout one’s entire life in order to improve one’s knowledge, skills and competencies from a personal, civic, social point of view and / or in terms of employment opportunities. Thus, people are able to face an ever changing world, being involved throughout their lifetime. Lifelong human resource training aims at developing every individual’s knowledge and skills, so that he/she can adapt to the educational society and actively participate in all areas of social and economic life, thus being able to better control his/her future. This goal can be achieved by enabling individuals to acquire and refresh all types of abilities, interests, knowledge and skills beginning with the years following initial education completion and ending with post-retirement.

At organization level vocational training is a profitable investment that leads to an increased employee performance and helps employees adapt to the technological and structural changes that may occur throughout the life period of an organization.

Currently, European organizations require more and more knowledge from their employees. In these conditions, European employers' associations have asked the European Commission for Education and Culture that all European educational levels should meet the modern requirements of companies and of the new knowledge based society. Modern educational policies tend to expand the concept of learning society characterized mainly by a paradigm shift from school centred education to lifelong learning through lifelong re-training programs.

Ovidiu Nicolescu identifies the knowledge-based economy main features: "hi-tech focus, main budget allocation support of education, training, learning and research, particular attention paid to entrepreneurship and enterprise”.

Not incidentally, lifelong training has been the most important aspect of the reform projects of all developed countries in the last decade. This is due mainly to the information explosion in all fields of economic and social life leading to an increasing ongoing vocational training need.

Currently, universities and other institutions and companies acting as lifelong training program providers are facing numerous challenges such as:

- knowledge internationalization, which means that skills, knowledge and competencies are the main economic development resources and the main competition criteria;
- globalization of sustainable development issues, which generates a global competition between the best universities and institutions;
- distance learning extension, based on human activities that have become common, such as innovation, creativity, teamwork, communication, cross-border cooperation and multi-disciplinarity.

The importance of labour market training, as a means of job stability and job access, is supported by the need to respond to the rapid change in new skills demand. The transition from school to the labour market is based on a general training, vocational training (specific) and on learning adapted to market requirements. As a related topic, the authors discuss the idea that employers are not in favor of academic specialization
preferring graduates with general training (foreign languages, IT or general management techniques) that should be trained within companies according to the actual job characteristics.

Career planning through lifelong learning requires a voluntary effort both from the employee (who should assess his/her available skills), and from the company which should consider the ways of achieving its own interest and the actual available means for this.

As a conclusion, lifelong education should help solve some of the problems present society is facing. For this purpose, it is necessary to refine the internal coherence between education systems and society and to ensure their stability and continuity in order to bring long term efficiency.

### 3. DIAGNOSTIC LIFELONG TRAINING ANALYSIS IN ROMANIA

If we assume that educated human resources are a key progress factor in the European context, special attention should be paid to the national training function. Having as a background the population decline and the uncertainty in finding a job upon study completion, we notice insufficient lifelong training structures both in terms of their number and of the way they are being organized, although there is a constant offer of re-training and skill improving programs.

Most lifelong training activities are currently organized within formal education institutions (high schools, universities, specialized institutions). Higher education institutions seem to best meet this need as they are well-known and they have qualified staff, appropriate equipment and infrastructure, a structured curriculum and the possibility to offer nationally and even internationally recognized certificates.

A fair and realistic assessment of the resources available to these institutions is a condition that is necessary but not sufficient. Until 2000, it was considered that investing in the material basis or endowing temporarily authorized institutions with permanent legal powers should be the priority, paying little attention to developing lifelong training programs.

Among the strategic objectives aimed at by the Romanian lifelong training programs it is worth noting the following:

- **Updating knowledge and skills** so as to match the challenges imposed by a global and functional economy.
- **Re-training.** Re-training helps those who lost their job find new jobs which often require a different qualification. Jobs that require university or high school studies need a different approach ranging from changing one’s qualification within the same job family to finding a different one.
- **Minimizing technology evolution effects.** The target group of these training stages is represented by the employees of the organizations that use state-of-the art technology (e.g. computer industry) and those which are experiencing new massive technological input. These persons require highly flexible training programs adapted to their life and work place.
- **Higher professional qualification.** This type of training addresses both employees and unemployed and aims at offering them the possibility of obtaining higher qualifications that should ensure easy job access.

The short and medium term lifelong vocational training strategy 2005-2010, approved by GD no. 875/2005, aims at developing a structured, transparent and flexible lifelong vocational training system, having an adequate funding level and actively involving the social partners, which should ensure workforce adaptability and mobility and a better employment rate and which should meet company needs for qualified workforce, taking into account the future economic restructuring and European market alignment.

This strategy set as a target for Romania an average lifelong learning participation level of 7% by 2010 for adult population (age group 25-64 years) compared to 1.3% at present.

This document’s aim is to achieve the strategic Lisbon objective: transforming by 2010 the European Union into “the most competitive and dynamic knowledge-based economy, capable of supporting economic growth by creating more jobs and achieving greater social cohesion”.

In this context, lifelong learning must be approached as an objective necessity imposed by the transition to a knowledge-based economy and society. In 2005, only one third (i.e. 33%) of the Romanian companies have organized training programs for their own employees; a higher percentage has been noticed in the following fields: electricity, gas, water supplies (59%), construction (44%) transport, storage and communications (43%), agriculture, oil industry (40%), while a lower percentage has been found in: trade (19%), hotels and restaurants, real estate (26%) and other business services (33%).

A lifelong learning ranking according to development regions shows Bucharest the first while the South of Romania ranks last.

The main reasons why about two thirds (i.e. 66%) of the surveyed companies did not organize training programs for their own employees are:

- company management is satisfied with employee training level .........................................................48%
- skills can be acquired directly at work ................26%
- insufficient resources ........................................12%
- attending training courses would have meant employees temporarily ceasing work.................................7%
- lack of local training providers.................................5%

(Lifelong vocational training within the technological development process of the Romanian economy-REPORT - Bucharest, April 2007)

In the current context of European work market it is necessary to adapt the legislative framework so as to ensure an increased role and responsibilities of the social partners concerning lifelong training, a public and private investment increase in lifelong vocational training and an adequate climate that should encourage lifelong vocational training participation. On the other hand, special attention should be paid to stimulating training providers so that the training offer should meet training demands at individual, company and even national level.
The percentage of people involved in lifelong learning is a challenge both for each individual and for organizations.

The European Union pays special attention to lifelong learning in order to achieve the strategic objective (Lisbon 2000) of becoming the most competitive and dynamic knowledge-based economy, capable of supporting economic growth by creating more jobs and achieving greater social cohesion.

The European Commission stresses the importance of partnership between public authorities, employers, trade unions, communities and voluntary groups by means of which they can undertake responsibility and work together to promote lifelong learning and to encourage people to undertake responsibility for their own training.

Classical schools redefine their roles. The role of institutional education is to train not to inform. In order to gather information one has to study individually, the school acting only as a guideline.

Statistical data place Romania among the countries that neglect lifelong learning. If in terms of classic education figures are close to the EU average, not the same is true for "lifelong learning". According to the data recently published by the European Commission Romania spends only € 109 annually for an employee training, while in Denmark the amount is € 1049; in Bulgaria and the Czech Republic the amount is € 293. Young Romanian people are generally self-taught and eager to work and to improve their skills, ceasing to wait for the state investments or training programs. Thus, Romania appears as a country with very few workforce training investments, however rich in trained workforce. This richness comes from people’s desire to have a better life.

According to a recent study, Romania has the highest primary education drop-out percentage in the region: 23% of the population aged 18 - 24 drop out of school. Romania has also the lowest percentage of people involved in the lifelong learning process.

### Table 1. Life-long learning.Percentage of adult population aged between 25-64 years participating in education and training courses (training courses longer than 4 weeks)

<table>
<thead>
<tr>
<th></th>
<th></th>
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</tbody>
</table>

Source: European Commission, DG EMPLOYMENT, SOCIAL AFFAIRS AND EQUAL OPPORTUNITIES. Indicators for monitoring Employment Guidelines including indicators for additional employment analysis (25/06/2009)

In the current context of European labor market it is necessary to adapt the legislative framework so as to ensure an increased role and responsibilities of the social partners concerning lifelong training, a public and private investment increase in lifelong vocational training and an adequate climate that should encourage lifelong vocational training participation. On the other hand, special attention should be paid to stimulating training providers so that the training offer should meet training demands at individual, company and even national level.

### Table 2. EU targets and Romania results

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Romania level</th>
<th>EU target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drop-out</td>
<td>11% of secondary education during 2002-2003</td>
<td>Maximum 10%</td>
</tr>
<tr>
<td>Young people percentage (22 years)</td>
<td>66,5%</td>
<td>At least 85%</td>
</tr>
<tr>
<td>Lifelong learning participation (25-64 years)</td>
<td>1,6% in 2004</td>
<td>At least 12,5%</td>
</tr>
</tbody>
</table>

Source: Center for Information and Educational Resources and the Ministry of Education, Research and Youth

Only 1% of the population aged between 25 - 64 years participated in a vocational training program with a duration longer than four weeks. Education expenses are the lowest compared with central and eastern Europe. In this context, school drop-out is another problem of the education system, and educating parents can play a central role. Some of the solutions for reducing and preventing school drop-out would be ensuring access to relevant information and developing parents-centred programs.

### Table 3. Percentage of higher education graduate workforce and the percentage of people aged between 25-64 years participating in LLL (2003)

<table>
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<tr>
<th>Countries / Country groups</th>
<th>The percentage of higher education graduate workforce</th>
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<td>EU15</td>
<td>24</td>
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<tr>
<td>EU18</td>
<td>19</td>
</tr>
<tr>
<td>Romania</td>
<td>10</td>
</tr>
<tr>
<td>Countries / Country groups</td>
<td>The percentage of people participating in LLL</td>
</tr>
<tr>
<td>Romania</td>
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<td>EU15</td>
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<tr>
<td>EU18</td>
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</tr>
</tbody>
</table>

Source: Eurostat
Workforce competitiveness in Romania is low compared with EU countries (estimated by the percentage of higher education graduate workforce). According to European Innovation Scoreboard 2005 the percentage of the population aged 25 - 64 who graduated a higher education institution is relatively small (10.6%) compared to the percentage of the 25 EU countries (21.9%). Lifelong learning (LLL) participation is also very low. Persons aged between 25-64 years participating in lifelong learning in Romania represent only 1.6% compared to 9.9% in EU-25.

The importance of lifelong vocational training has led in the last years to increasingly intense efforts for creating an appropriate legislative framework, to the establishment of specialized institutional structures and offer diversification and to the development of a “lifelong training programs market”.

Universities and other institutions and companies acting as “lifelong training program providers” are facing numerous challenges such as: knowledge internationalization, globalization of sustainable development issues, distance learning extension, based on human activities that have become common, such as innovation, creativity, teamwork, communication, cross-border cooperation and multidisciplinarity.

European organizations require more and more knowledge from their employees. In these conditions, European employers' associations have asked the European Commission for Education and Culture that all European educational levels should meet the modern requirements of companies and society.

Organizations require that educational system products should also have, besides basic knowledge, training flexibility, evolutionary and diverse skills, learning ability and the capacity to enter into and maintain social relationships.

Taking into account the deep changes occurring in education systems and the increasing interest in lifelong training programs it is necessary to develop methods of evaluating the effectiveness of these programs that should contain criteria related to the new education requirements imposed by organizations.

In order to be competitive, organizations should stimulate all level learning, that is to say should become learning organizations. Organizations learn only through learning individuals. Individual learning does not guarantee organizational learning, but without individual learning organizational learning can not be achieved. The studies that were published in this area focus on the management tools necessary for building an environment suitable for learning and experimenting. Organizations, seen as learning entities, are considered in relation to the employees who work and learn, emphasizing the need for manager active involvement.

Shifting from individualist competition within an organization to partnership and constant learning makes the employees aware of the organization objectives and makes them familiar with team work, aiming at achieving the organization objectives.

5. CORRELATING LIFELONG LEARNING TO WORK MARKET, UNEMPLOYMENT AND EMPLOYMENT RATES

Correlating lifelong learning to work market is quite unclear. If an adult person learns a new job, he/she will have better opportunities of finding a job on a flexible work market, reducing unemployment and increasing employment rate. On the other hand, a person who retired from activity but who wants to go on with his/her education and to be active on the labor market may take the job of a less experienced and less focused young person. Too many qualifications are not very useful either because that person may become unsatisfied with the job offers, case in which lifelong learning becomes counterproductive.

Table 4. Education level achieved by young persons. Percentage of population aged between 20-24 years who graduated higher education

<table>
<thead>
<tr>
<th></th>
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</tbody>
</table>

Source: European Commission, DG EMPLOYMENT, SOCIAL AFFAIRS AND EQUAL OPPORTUNITIES. Indicators for monitoring the Employment Guidelines including indicators for additional employment analysis (25/06/2009)

Access to information and education still faces some persistent obstacles such as the lack of motivation of some unemployed or aged persons, and also the lack of opportunities for young persons and adults in rural areas, transportation difficulties, difficult access to education of elderly population, the costs of higher education and of private training opportunities.

The main measures adopted by several countries in order to improve access to education focus on upgrading education and training systems, including introducing national qualification standards, recognizing previous acquirements, promoting transparency.
Table 5. Life-long learning. The percentage of inactive adult population, aged between 25-64 years, participating in education and training courses (training courses longer than 4 weeks)

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
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Source: European Commission, DG EMPLOYMENT, SOCIAL AFFAIRS AND EQUAL OPPORTUNITIES. Indicators for monitoring the Employment Guidelines including indicators for additional employment analysis (25/06/2009)

Related to the percentage of inactive adult population, aged between 25-64 years, participating in education and training courses (training courses longer than 4 weeks) only Bulgaria ranks worse than our country. The percentage of inactive population falling in this category is nearly one third of the EU average.

According to the resolution relating to lifelong learning (27 June 2002), the European Union Council states that education and training are essential means for promoting social cohesion, active citizenship, professional and personal fulfillment, adaptability and employment. Life-long learning increases free mobility for EU citizens and helps achieve the European Union aim of becoming more flourishing, more competitive, more tolerant and more democratic.

Table 6. Education level of adult population. Percentage of active adult population aged between 25-64 years according to education level

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<td>32.3</td>
<td>33.0</td>
<td>34.1</td>
<td>32.7</td>
<td>33.2</td>
<td>34.4</td>
<td>35.6</td>
</tr>
<tr>
<td>Romania</td>
<td>Low educational</td>
<td>28.8</td>
<td>27.0</td>
<td>24.3</td>
<td>25.2</td>
<td>22.4</td>
<td>21.4</td>
<td>20.2</td>
<td>19.8</td>
</tr>
</tbody>
</table>

Source: European Commission, DG EMPLOYMENT, SOCIAL AFFAIRS AND EQUAL OPPORTUNITIES. Indicators for monitoring the Employment Guidelines including indicators for additional employment analysis (25/06/2009)
Table 6 shows us the structure of active population aged between 25-64 years, according to the attained education level, namely: low, medium and high (higher education).

The data analysis shows that Romania ranks last of all EU countries in relation to the percentage of higher educated population, at about half the EU average, even though these figures are annually increasing. All countries in this table faced during 2000 - 2007 (the reviewed period) with a decrease in the percentage of the population in the first category - low educational, a consecutive increase relating to Medium educational and a strong increase relating to High educational.

Education and training system should adapt both to the knowledge-based society requirements and to the need of improving the employment level and quality.

Within the European Employment Strategy, Member States submitted their national action plans in May 2002, containing detailed information on national lifelong learning strategies, although mainly from the work market perspective. The Commission has used this information in carrying out its report on lifelong learning.

Basic knowledge can be provided by education and training systems and should represent the foundation of employment prospects and enable individuals to learn on their own. Technical knowledge is partly acquired within education and training systems, partly at the workplace.

Some states have introduced programs meant to raise the awareness of people who drop out of school. For these countries, bringing these young people back to school is a priority. The measures that were taken are specific to each country, e.g. in Hungary and Slovenia, the program "Vocational training development from the point of view of content, methodology and structure” aims to develop a training alternative that should include pupils/students in danger of dropping out of school. The program also includes teacher training.

In Poland, the "First work" program within the governmental social and economic strategy "Entrepreneurship. Development. Work" was implemented in 2002. The aim was to help young people obtain a first professional experience which enabled them to check their knowledge level and skills acquired in school and to increase their chances of finding a job. The program has introduced new mechanisms and offered benefits for career start. The most important mechanisms are:

1. funds allocation for the development of university offices for career and information centers;
2. distributing among high school students the booklet "Vocational counseling guide for future high school graduates”;
3. distributing the guidebook "Independence in finding my first job" for information and group activity training;
4. publication of a material called "Vademecum of positive practices” issued as a set of guidebooks presenting the most important solutions for graduate performance;
5. implementing the “Green workplaces” project focused mainly on forestry high schools graduates and on the children of former state farm workers.

As part of the "First work" program, graduates participated from June 2002 to May 2003 in active work market programs, training courses, employment incentives. 600000 graduates have received support in the form of vocational guidance or support from job agencies.

6. CONCLUSIONS

The role of school today is to establish systems of moral values, that are not subject of degradation, to offer general and basic knowledge, to create the basis of adaptation to the change.

The permanent training represent a challenge both for every individual and for organizations. The continuous training of the human resource aims to promoting the development of individual knowledge and competence, so that he could adapt to the educational society and to actively participate in all the areas of economic and social life, having an increased control over his future. This aim can be touched by offering the possibility for individuals to get and improve all types of abilities, skills, interests, knowledge, beginning with the years after they and the initial training and finishing with the period of post-retiring.

It is not a happening that the continuous training represents the most important aspect approached in the last decade in the reform projects of all the developed countries. This owes, mainly, to the information explosion of all the areas of the economic and social life, leading to an amplified need of a permanent professional training.

The competitiveness of the Romanian work force is lower than that belonging to the European countries, the percentage of the population aged between 25 and 64 years that graduated a kind of university studies is low (10,6%), compared to the percentage recorded by the 27 EU countries (21,9%). Even the participation in the lifelong learning is very poor. The individuals aged between 25-64 years, who participate in the continuous education in Romania is of 1,6%, compared to 9,9% in EU 27 countries.

The importance of the continuous professional training has led, in the last years, to concerning more and more intense, in order to establish an adequate legal framework, to establishment of some specialized institutional structures and to diversifying offers, and to development of a “market of programs on continuous education”.

7. REFERENCES

UNESCO POLICY, STRATEGIC GOALS OF EUROPEAN UNION CONCERNING EDUCATION AND NATIONAL CAPACITY DEVELOPMENT IN EDUCATIONAL PLANNING AND MANAGEMENT

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ABSTRACT: Compared to other socio-economic sectors, educational development involves more difficult and multidimensional problems. Faced with financial constraints, governments in many countries are not able to meet the broad social demands without adopting restrictive measures within the education sector, while rationalising the use of allocated resources. In the dynamics of educational management of student flows, as well as that of public finance, they have to make difficult decisions to regulate the utilisation of resources, without leading to serious disruptions and dysfunctions. Because there are too many actors, variables and the interrelations between these, it is necessary to have not only a reliable information system but also many other technical tools to facilitate policy consultations and policy-making. The aim of this article is to resume the strategic goals of UNESCO and European Union concerning education, to assess information systems and technical tools to facilitate policy consultations and policy-making, and study the impact on Romanian Higher Education planning and management; on policy formulation and capacity development of Romanian universities Through this paper we wish to contribute to the debate on decentralization policies in education in the context of the Education for All (EFA), while seeing how they can be taken into account in the preparation and implementation of national plans of action in the case of military.

1. STRATEGIC GOALS OF EUROPEAN UNION CONCERNING EDUCATION

The investment in education and in shaping people is the most profitable in the long-term development of a society [1]. Thus, the education and instruction institutions, as well as the research ones, are regarded as strategic institutions for the national destiny.

After the Declaration of Lisboan, the European Union set up as a strategic goal to become the most competitive economy based on knowledge, capable of a lasting development, its foundation being education. In this context, the education system also undergoes a rapid process of changes in priorities. The basic knowledge, the formal classical information, as well as the common abilities obtained are shadowed by the necessity of a complex development, by the acquisition of personal experience through experimenting, working in teams, engaging in relevant, motivating activities. As to the dimension to the education quality, this is based on the Declaration of Bologna (1999), as well as on press releases signed by the education ministers within the meetings in Prague (2001), Berlin (2003), Bergen (2005) and in Malaga, Heidelberg, Frankfurt (2007). On 27 December, in Helsinki there took place the Conference of the 33 European ministers responsible for professional forming, of the social European partners and of the European Commission took place, revising the strategic priorities as defined by the Copenhagen Process. The recommendations for the period 2006-2010, encompasses in the communiqué adopted there, underline the following strategic priorities:

- the professional forming must become in itself a priority of the national politics so as to increase the attractiveness of this form of learning that should last all life as well as the quality of
- the involvement of the social partners, the development of some personalized preparation programmes which should meet the options and the interests of persons and companies, their validation and the recognition of the preparation and of the experience that have previously been acquired, all these are the elements that sustain the above-mentioned priority. The identification of the common elements of the professional forming (VET) and the tertiary education (non-university higher education) was sustained and underlined as facility in the favour of those who learn, who should be supported in order to continue their tertiary studies.
- the professional forming at European level should continue the development and the use of some instruments common to the member states, i.e. the European Framework of Qualifications (EQF), European System of Credits in VET (ECVET), European Framework of Quality Insurance in VET promoted through the trans-European inter-institutional network of ENQA-VET, EUROPASS. Again, the correlation with the instruments specific to tertiary non-university education was underlined. (for example: transferable credits ECTS, ensuring quality, the qualifications framework, EUROPASS).

Figure 1. Main components of EQF

- the cooperation at European level and the promoting of good practices, using relevant data and statistics base on which a comparative analysis is possible;
• the involvement of multiple social factors, among whom are the local authorities, the local social partners, especially those that represent the sector structures, the teachers, and the ones that form, the family and the students.

The Helsinki Conference represented the second moment of analysis, after the Conference of the ministers in Maastricht in 2004, of the progress regarding the contribution of the professional forming to the achieving of the objectives assumed by the European Council from Lisbon, and whose fulfilment is forecast for 2010.

During the conference in Berlin, the European ministers of Education elaborated the system of qualifications for the higher education (the description of the qualifications from the perspective of the competences and the specialization). The main elements of national framework of qualifications contains are the cycles or the levels, the credits and the amount of work, the specializations. A new element in most of the countries refers to the results of the system education, because this factor represents what is expected of a student or pupil to know, what he is expected to understand and use in practice. The results of education must focus on the achievements and it must also facilitate the passing from teaching to learning.

In the context of military modernization and organizational changing efforts [1], the present is set off from the past by the current heavy reliance on knowledge resources and organizational learning [2]. New technologies resulted in increasingly dynamic, unpredictable and complex operations that require the officer to filter and analyze information from multiple sources to attain knowledge superiority.[3] The Romanian Army’s acceptance into NATO outlined for the Romanian military institutions the need of profound conceptual and organising transformation. The Romanian officers working in Iraq, Bosnia, and Afghanistan with joint or combined forces in coalition situations require the ability to communicate and coordinate operations in a seamless environment. As a result, the Romanian army needs innovative and creative soldiers, to fight the future’s digital warfare [4]. Military Academies must re-design the status of the military personnel in terms of knowledge and skills in accordance with the changes taking place within the Romanian military structure.

2. UNESCO AND EDUCATIONAL DEVELOPMENT

UNESCO supports the Member States in the field of policy formulation and capacity development in educational planning and management in the form of technical assistance in the design of education sector development plans, programmes or projects and their implementation. The development of UNESCO National Education Support Strategy (UNESS) documents is required for the Organization to ensure its pertinence and effectiveness in response to countries’ identified needs and demands for national educational development by supporting their policy priorities and filling the critical gaps in terms of expertise, capacities and finance, in synergy with the development of the community’s contributions. The UNESS documents themselves are analytical arguments for UNESCO’s in-country strategies including a critical analysis of the roles the Organization has played and is playing in each of the countries concerned. According to the Dakar Framework for Action, all States should “develop or strengthen existing national plans of action by 2010 at the latest” building on existing national education sector development strategies. The plans shall address problems associated with the chronic under-financing of basic education by establishing budget priorities that reflect a commitment to achieving EFA goals and targets. Specifically, each National Plan of Action, designed within sector-wide development framework is to:

- be developed by government leadership in direct and systematic consultation with national civil society;
- attract coordinated support of all development partners;
- specify reforms addressing the six EFA goals;
- establish a sustainable financial framework;
- be time-bound and action-oriented;
- include mid-term performance indicators;
- achieve a synergy of all human development efforts. UNESCO proposes a set of “generic” criteria that can be used, flexibly according to countries’ planning practices, for assessing the credibility of the national action plans for EFA achievement. The credibility of National EFA Plans depends largely on three types of prerequisites:

- national leadership, commitment and sustainability;
- internal funding complemented by external financial support;
- reliable information and monitoring system.

To satisfy the necessity of generating an increasing trust on long and medium term, in the capacities and performances of the universities on European market (in the context of the intensifying of the competition for students and resources) on international level quality indicators have been defined. The degree of implementation of the educational policies can be accomplished by statistical multidimensional analyses using the SNIE (Statistic National Indicators for Education) indicator system. This system follows the evaluation of the educational system and vocational training from different perspectives: at global or local levels. The proposed criteria are intended to be generic and can be used flexibly (e.g. checklists, score sheets, etc.) The used conceptual framework was defined by UNESCO Statistics Institute and objectified at a national level in the OECD handbook [5] (see Table 1).

Table 1. The matrix of classification of the indicators for education

<table>
<thead>
<tr>
<th>Category</th>
<th>Subcategory</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Individual participants in the educational process</td>
<td>1. Results and products of education</td>
<td>A. Quality of the training process</td>
</tr>
<tr>
<td>B. Training requirements</td>
<td>2. Factors influencing the implementation of the educational policies</td>
<td></td>
</tr>
<tr>
<td>C. Providers of educational services</td>
<td>2.A. Individual characteristics, participation, and behaviour</td>
<td></td>
</tr>
<tr>
<td>D. Educational systems as a whole</td>
<td>2.B. Learning conditions and teachers' working conditions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.C. University environment and organization</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Context and conditions influencing the implementation of the educational policies</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.A. Learners' previous characteristics</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.B. Students' learning conditions and teachers' working conditions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.C. Characteristics of the service providers and their communities</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.D. National system (educational, social, economic and demographic)</td>
<td></td>
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</table>

In the case of countries looking for external funding for the implementation of their EFA Plans, these criteria can help demonstrate national commitment to EFA Goals. By making the programmes compatible partnership relationships between institutions are established. The partnership is reflected in the following concerted actions: a) the partners inform one another about the student’s performances and behaviour; b) they facilitate each other’s educative actions; c) each partner takes action whenever and wherever he is asked for support, and d) each partner’s contribution will be judged according to the results of his work with the students.
3. NATIONAL CAPACITY DEVELOPMENT IN EDUCATIONAL PLANNING AND MANAGEMENT

At the national level, the government, the professionals of education and research, and the different associations and reflection groups are trying to bring adequate solutions. At the international level, multilateral and bilateral cooperation agencies are contributing financially or technically to the national programmes of educational development. The reform programme in Romania requires complex operations that entail great technical and political problems:

- The problems and aspirations are great, but the resources are scarce. Elaborating a programme requires, above all, the capacity to make the difficult policy options and strategies that can be afforded financially;
- Because of size, geographical spread and the variety in the kinds of curriculum and administrative levels, the education system is extremely difficult to manage. Many actors and interest groups are affected by the decisions in the field of education.
- Not only are there the intellectual and technical difficulties of knowing, analysing and heading a sector that is as vast as it is complex, but there are also those of a political order to obtain the consensus, or at least the compromise, of the many actors involved.
- For the educational development, in the field of national educational policies and strategies main necessity is to provide a focused support in the development and/or reinforcement of national education sector plans for achievement of the Education for All (EFA) Goals.

The finalities mentioned and accomplished on a higher level, can improve the capacity of the deciding part, with consequences in medium and long term, in the social existence, inclusive over the perception of the civil society on the quality of the educational system.

After the consultation process on the European Framework of Qualifications (finalized in December 2005), Romania decided to develop a National Framework of Qualifications (CNC) correlated with EQF. This strategic orientation will allow comparing CNC in Romania with other national frameworks of qualifications and improved transparency, quality and relevance of qualifications in Romania; they facilitated professional progress and the mobility of students, teaching and research staff. In Romania there are 49 state institutions of higher education and 23 private accredited institutions of higher education. The competition on the educational market in Romania is a tough one, because the private sector has already come up with an attractive offer and the state institutions also try to improve themselves. In this context, the application of the Bologna Process was not very simple. The technical education still lasts 4 years. The engineering education has a very good tradition. There are many technical domains in which we excel in Europe. We would mention the IT domain. The technical faculty considered that adopting a three year forming period does not agree with the curricular structure of this sector. Bologna meant also an increase in the efficacy of the university expenses. The number of specializations has been reduced. By reducing the number of specializations, the number of students for each specialization has increased.

The Quality Law has been issued: it is the Emergency Ordinance no. 75 of August 2005 regarding the ensuring of the Quality in Education which defines the quality in the education system for the satisfaction of the direct beneficiary, the pupil, and the student respectively or indirectly, the parents and the society. This law stipulates an external evaluation, as well as an internal one, performed by any educational institution; this can create some interesting premises in the development of the education system. During transition, the system of education registered certain regresses. It took a long time until every university found its curricular area. The case of the military institutions is relevant from this point of view, especially due to the double specialization given to the graduates that acquire numerous capacities (fighter, manager, branch specialist, etc.) and capabilities (e.g. to lead military subunits, to use the weaponry and the technique, etc) that they intend to develop in correlation with the requirements of the market.

The education policies specific to the military higher education are based on the National Framework of Qualifications (the opening of the military environment to the requirements of the labour market by providing students with double specialisation), the requirements established by the education goals objectified in the graduate’s ideal which encompasses the competences assumed by the academies corresponding to the different branches of the army. These competences are reflected in the education contents included in the university curricula, according to the general standards and those specific to the higher military education. The professional forming of officers is achieved within a specific military environment, integrated into the national education system, and the measures recently taken in order to develop the military education have become a symbol of high professional standards.

4. ACHIEVEMENT OF EDUCATION FOR ALL (EFA) GOALS

EFA Action Plan [6] refers to:

(1) "Long-term strategic plan or framework" [6] for the achievement of EFA Goals [3] by 2015 at the latest. EFA plan has been conceived as a dynamic and evolving exercise permitting mid-term updates and necessary adjustments to national EFA policies [7] and strategies.

(2) Clear strategies for overcoming the hurdles facing those excluded from educational opportunities, i.e. girls and women, ethnic and/or linguistic minorities, children with special needs

(3) Depending on country specificities, measures to improve quality include: the creation of safe, healthy, equitable and inclusive educational environments, definition of learning achievement levels including life skills; enhancing the status, morale, professionalism and training of teachers; educational programmes conducive to changes in attitudes and values etc.

(4) "Medium-term plan" is an operational rolling plan (in general, 3-5 years according to countries’ planning practices)

(5) Policy options and strategies, including exploration of pedagogical input mix (i.e. teachers, didactic materials, learning spaces, pedagogical organization, etc.) and development of alternative scenarios in consultation with concerned stakeholders will be issued.[9]

The general principles of reorganizing the proper functioning of the Romanian academic education system are based on UNESCO policy, EFA policy vision and national socio-economic development strategies. Responsibilities are well defined, and ARACIS and GNAC managerial institutions are operational. Sector assessment is carried out on the basis of recent studies and surveys, outlining the strengths and weaknesses of the system, in terms of:
• access to and equity in education, including gender and disadvantaged groups;
• quality and relevance, including quality indicators, learning achievement and internal efficiency;
• sector and school management, including governance, financial planning and management, etc;

The question of decentralization in education is addressed in the Dakar Framework for action as an option to be developed to achieve better governance of education systems. The national experience reveals the complexity of educational reform and decentralization processes. There are many factors involved, including the new linkages between the different actors and the different levels of responsibility, problems of reform financing and continuity, and the definition and implementation of new modes of participation, dialogue with teachers, training and evaluation. The challenges of decentralization in education are then just as much political as technical.

5. EFFICIENCY AND QUALITY IN MILITARY UNIVERSITY EDUCATION

The global social transformations, the evolution of security medium and the economical developments have imposed profound mutations not only in the contents of learning but also in the educational management. The particular case of military education is relevant. The concept of effective action has been long considered the domain of economics and less of education. Education, although a social level, was not designed strictly for this purpose but more likely for social security activity which proves the quality and effectiveness of products, the labour force. If the graduates will prove to be competent in the profession then their education has been effective and of high quality. Decades of education among producing and consuming resources proved to be valid. Today, when we are facing an economic crisis we must strive to support an educational process that should be based on the paradigm of efficiency and quality. By efficiency we understand the educational curriculum competencies required by the customer at the highest parameters in an optimal time and financial investment reduced. Likewise, through quality education we understand that the skills, capabilities, abilities, and formats developed in the educational system have the accuracy required by the needs and social realities that can be transformed or adapted in relation to social evolution of the working environment.

Despite the more obvious similarity with other civilian profession, the military profession has a unique character, namely the fact that its only “customer” is the nation and the military are professionals serving the nation. In short, it can be asserted that the officer as a prototype of the military professional possesses an intellectual qualification acquired through a long period of academic building-up. Higher military education has the difficult task of recruiting, selecting, building-up and perfecting the human resource capable to integrate both into the military system and into civilian organisations. Military institutions must strictly obey the rules of efficiency and quality in all areas, including those of education. Thus, military education, and social education in general, contains all three forms, namely: formal military education, military non-formal education and military informal education. The only form of military education which is subject to the requirements of efficiency and quality is the formal one. Military university education is the most important and valuable part of formal military education. Due to product characteristics, graduates with a bachelor degree have some unique features and give the subject and the general rules of formal academic and military education

Bologna process has been designed precisely to improve education and to establish the organizational framework and rules under which university education should run to attain its objectives, in terms of low costs and maximum benefits. Applied to the military academic education, the Bologna process has beneficial effects on quality and efficiency and produces outstanding institutional changes. More specifically, following the established rules at Bologna, the military must obey strict rules of quality education and train cadets able to satisfy the social needs and due to the credit system to be able to redirect the graduates to other sectors of society, when needed. For some time now, Romanian military education system is trying to register in efficiency and quality requirements imposed by the Bologna process. It is trying, because the measures taken so far have not generated an efficient and competitive education system, but rather responded to the needs and requirements in the short run. Scientific studies undertaken in this field have shown that university education is not characterized by formative consistency. Thus, a graduate of a military academy with an initial three-year period of study and a bachelor degree can not attend a programme of master studies earlier than 16 years from graduation and a PhD programme earlier than 18 years.

By not offering the opportunity to continue master studies in the military institution, many graduates follow up master studies at various civilian institutions of higher education, after giving up the military career. All these shortcomings affect the quality and effectiveness of military education. We believe that if we want to achieve both the efficiency and the requirements of high quality education each military institution should be granted the opportunity to function by having at least the first two programmes of university studies (Bachelor and Master). Another requirement arising from the application of the principle of educational effectiveness is the existence of a strong bilateral relationship between all the beneficiaries of the military institutions of higher education. Customer needs of qualified professionals in accordance with both the evolution of the military phenomenon and with sufficient quantities so as the military should operate at design parameters should be a priority for the military institution. In reality, the beneficiary has a large deficit of highly qualified staff when it comes to the ranks of second lieutenant, lieutenant and captain and some surplus staff with the ranks of major, lieutenant-colonel and colonel. On the other hand, in certain positions in which certain skills are necessary to effectively solve the service tasks civilians with little or no connection to the job are hired. Military education should be viewed as a process or system of great complexity, constantly changing and adapting to the realities of the military phenomenon, as well as to also those of society in general. This undoubtedly involves measures of action on behalf of the decision makers so as to give candidates opportunities to acquire general and specific training created at the highest parameters of quality and efficiency. [5]

To reach this goal, several courses of action should be taken especially in the administrative regulation and the educational curriculum itself such as:

• Avoid duplication in terms of preparation of the (future) military; administrative subordination should be regarded as a general principle, performed by a board of directors to oversee and harmonize the proposals and action components. In particular, each structure to be free to decide the limits
(enlarged university autonomy). For example, in the case of the graduate, each step of schooling should be decided by each structure separately but together with the beneficiary;

- Implement a system of simple and clear criteria on trends in the military career, in which there is a direct link between the nature of the individual studies and military position, complying with the provisions of MECI (Ministry of Education, Research and Innovation) and those of the beneficiaries – MO (Ministry of Defence), SRI (Romanian Service of Information), SPP (Guard and Protocol Service), etc.; and resizing-military institutions of higher education in direct relation to the dynamics of graduates;

![The evolution of personnel 2003/2010 on programs (DPD)](image)

**Figure 2.** Trends in military career

- Establishment of requirements for university graduates, (what to be, know and do) for each officer rank, particularly in positions of leadership, even at the lowest level
- Maintain, expand and improve the current rules by which the committees review and approve the rules and doctrines
- Better use the experience gained by the military attending various military missions abroad
- Increase the frequency and number of instructors and teachers sent to military theatres of operations, in order to be better informed and improve the contents they teach.
- Ensure a greater objectivity of the assessment. On selection of the military special kinds of programmes of training, directly linked to the position that will subsequently be employed, should be followed, thus increasing the efficiency of learning, focusing on certain specific issues necessary in the future job;
- Create and operate a system of rotation (once every 3-4 years) of the military having teaching positions, in different educational institutions or other military structures that have common discipline (disciplines) for a strong educational act that is appropriate, effective and fully connected to the realities of the Romanian military system;
- Establish rules, clearly specified by orders and instructions, that any training period must have a clearly defined purpose, performed into a competitive environment which should lead to increased effectiveness of education from all points of view;
- Enhance exchanges at the level of teachers and students with similar educational institutions of NATO member countries and / or the EU to increase compatibility in relation to the academic system and also for a more consistent transfer of knowledge, teaching methods and procedures, evaluation system, testing, teaching experiences, etc.;
- Create the appropriate conditions for the teaching staff to prepare for and update the educational act by granting them access to software, data bases, etc.
- Take measures concerning the educational curriculum itself: change the structure and the contents of learning by selecting the appropriate disciplines and their hierarchy, in terms of importance, number of hours allocated to evaluation forms, etc, in the light of realities, and the possible changes, which is called to respond to the granting, harmonization, unification at all levels of training in all military educational institutions, achieving consistency between the studies followed and the staggered military. [8]

Stress the importance of knowing foreign languages (especially English), by increasing the number of classes for this purpose, so that during the third year of study, a vast majority of teaching activities could be conducted exclusively in English- by achieving this goal students will be able to improve the military and NATO terminology in English:-;

- Involve more teachers, and students in research projects on topics of current interests to the Romanian army;

Improve the educational quality by establishing and implementing the institutional procedural means of evaluating, of the European Framework of Qualifications (EQF), the European System of Credits (ECVET), that can facilitate the professional progress and the mobility of students, teachers and research staff. Romania’s joining the European countries requires that the military education be developed and modernized as an integrant part of the national education system, without losing its personality and identity, but also maintaining its compatibility with the NATO member armies’ education systems. In Romania we find 49 state institutions of higher education and 23 private accredited institutions of higher education. The competition on the educational market in Romania is a tough one, because the private sector has already come up with an attractive offer and the state institutions also try to improve theirs. There are many technical domains in which we excel in Europe. The case of the military institutions is also relevant from this point of view, especially due to the double specialization given to the graduates and to the numerous capacities (fighter, manager, branch specialist, etc.) and capabilities (e.g. to lead military subunits, to use the weaponry and the technique, etc) that they develop in correlation with the requirements of the market.

6. THE SOCIAL STATUS OF THE MILITARY PROFESSIONAL

In order to characterize the social status [9] of the officer, we considered the following dimensions as being relevant: the professional dimension, the economic dimension, the family dimension and the social dimension. We will had in view the determination of the opinion on the level of professional training of the military personnel, the determination of the level of complexity of the roles prescribed by the military profession in the new social context, as well as the determination of the degree of agreement between the officers training and the new theoretical, practical and methodological requirement with regard to their professional training. The cultural dimension is based on the determination of the perception on the way the military personnel relate to the general cultural norms and values and on the determination of the image of the professional knowledge. The political dimension represents another major aspect. This refers to the extent in which the individual takes part in the political life, which is the power that the decision-making factors give him credit for and which are the rights he owns as opposed to other professions. The determination of people’s perception of the income earned by officers and the standard of life it entails, of the value of this income in relation to the incomes of other jobs that require the same level of education, of the relation between the income and the job specific tasks, as well as people’s view of the facilities offered by the military profession are key aspects that govern the analysis of the social-economic
dimension. The familial dimension concerns the facilities an officer’s family can benefit from, as well as the general impression people have of the military families. The last but not least dimension is the social one. Under this aspect we considered the officer’s social rank within the military institution, the civilian population’s impression regarding the officer statute as well as the image referring to the values specific to the military profession, such as: dignity, honesty, credibility etc.

In an attempt to synthesize the theoretical and practical acquired experience, we performed a survey which led us to some conclusions. The answers were processed by means of SPSS soft [10]. The classes that strongly agree and agree on the optimum level of theoretical training of officers represent about 75%. The analysis of the social-economic dimension focused mainly on four indicators: people’s perception of income, of income in relation to job requirements, of income in relation to other jobs, and last but not least, of the great amount of facilities officers benefit from. Referring to officers’ income, 60% of the entire population believe it to be average, whereas 35% believe it to be below the minimum threshold of national average salary. According to the target set answers it seems that although officers’ education is not considered to be higher than that of other professional categories, the responsibilities and obligations entailed by the military profession are considered superior especially in terms of the incomes earned: 50% expressing their disagreement regarding the facilities offered by the military institution whereas 41% expressing their agreement. There is a strong correlation between the perception means and the indicator aiming at establishing the agreement. There is a strong correlation between the perception means and the indicator aiming at establishing the perception on the officers’ family living. Thus, 80% consider that the military families benefit from numerous facilities. As for the officer profession compared to other professions, we need to highlight the high level of interest of the data provided. On the one hand they were asked to compare the officer position with 2 other ones. The results prove that they chose teaching and psychological professions. For the first one there were 40% while for the second 42% votes expressed. On the other hand they were presented a list of tasks in order to evaluate them on a scale from 1 to 15, in terms of social prestige: 18.6% place the military position on the first rank followed, 6% and 14% on the second and third rank.

7. CONCLUSION

It is undeniable that the contemporary social, political and economic context determines academic education to promptly and efficiently deal with changes that are very quick and difficult to manage. That is why, in this new context, quality and its ensuring become key desiderata for the optimisation of the balance between projected requirements and final satisfaction. The improvement of educational quality by establishing and implementing the institutional procedural means [11,12,13,14,] of organising training, evaluating and controlling the quality, will facilitate professional progress and the mobility of students, teachers and research staff.

The necessity of developing an institutional culture for the education quality and for the protection of education end-users, as well as Romania’s joining the European countries requires that the military education be developed and modernized as an integrant part of the national education system, without losing its personality and identity, but also to be compatible with the NATO member countries’ military education systems and structures in terms of educational offer and aims. The need to build a clear and concise military system for education quality management which is focussed on the “added value” and “created value” [15] and which is substantiated on self-evaluation and institutional development [16] has become apparent. In order to achieve this objective, the Land Forces Academy and the training centres subordinated to it must find efficient solutions so that the education-training process could be designed and built up in order to meet the beneficiaries’ requirements and to face the changes in the army due to the organization, doctrine and action in the current geopolitical context.

We hope the present paper sets the basis for new challenges and transformations highlighting the military institutions.

8. REFERENCES:

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11. Law. 288/2004 on the organization of university studies;
13. ***, Case nr.404/2006 Government on organization and conduct studies masters;
14. ***, Case nr.1418/2006 Government for approving the methodology for external evaluation, standards, standards of reference and a list of performance indicators to ARACIS;
EVALUATION OF GRADUATE ACADEMIC QUALIFICATION

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ABSTRACT: Three fundamental areas of quality assurance in education must be taken into consideration for an organization which aims to become or already operates as a higher education institution: institutional capacity, educational effectiveness and quality management. To address the issue regarding the educational effectiveness in Lucian Blaga University of Sibiu (LBUS), we designed a survey to assess RAQAHE performance indicators like as: employability within the field of the academic qualification, access to the next level of academic studies and level of students’ satisfaction with regard to their professional and personal development ensured by our institution. The results of the survey suggest that knowledge, competences and skills acquired by LBUS graduates are sufficient for them to integrate in the labour market, to develop their own business, to access to the next study cycle and to continually learn and develop. In this article we present the methodology after which the survey was conducted and preliminary results of the investigation.

1. PRINCIPLES OF QUALITY ASSURANCE IN HIGHER EDUCATION

1.1. Transformations in Romanian Higher Education

Beginning with 1990 year numerous, radical and continuous changes have taken place in Romanian Higher Education (RHE) – the diversity of higher education institutions; the multiplication of program formulas; the growth of higher education institutions’ complexity and size, in terms of number of study programs and students; the promotion of good practice in academic performances like as in the foreign universities; the participation in the European Higher Education Area and the globalization effects – that are forcing institutions of Higher Education to adapt new strategies and address challenges adequately to remain competitive in the market.

As a consequence, Law no. 88/1993 on Accreditation of Romanian Higher Education Institutions and Recognition of Diplomas was adopted. Based on this Law [1], the National Council for Academic Evaluation and Accreditation (NCAEA) was created. Between 1993 and 2006, NCAEA was responsible of assuring the quality and the accreditation procedures for RHE institutions. Starting 2006 a new Law for Quality Assurance in the RHE System was adopted [2] and the Romanian Agency of Quality Assurance in Higher Education (RAQAHE) was established. This agency cooperates with Higher Education institutions from Romania and abroad, as well as with other European institutions (ex.: European Network for Quality Assurance in Higher Education - ENQA), in order to support the efforts of assuring quality of higher education in Romania at the level of European Union requirements. One of the main responsibilities of the agency is to assure periodically, at request, external assessment of their missions and objectives is respected and encouraged by means of the external evaluation of quality.

1.2. RAQAHE fundamental principles of addressing the quality of Higher Education

According to the legislation in force, the achievement and evaluation of quality have both an external and internal dimension. The external dimension was instituted by the Bologna Process which is based on a programmatic document (the “Bologna Declaration”, 1999) adopted by all Ministers responsible for higher education in the member countries and the Communiqué’s signed by the Ministers of Education at the meetings held in Prague (2001), Berlin (2003), and Bergen (2005). The rigorous implementation of the set of provisions established at a European level is required for the registration of national agencies for quality assurance, including RAQAHE, in the European Register set up by the European Network for Quality Assurance in Higher Education (ENQA).

The internal dimension of academic quality builds upon the legislation in force, the specificity of each higher education institution, and the tradition and cultural patrimony of our higher education system. It falls entirely under the responsibility of each higher education institution or provider of higher education programs. From this perspective, quality assurance becomes a process adapted to the existing institutional specificity and a mechanism for permanently improving academic performance or results.

For this reason, the RAQAHE principles of reference [3] are specified hereunder:

- European dimension: the Romanian Higher Education system and its institutions belong to the European Higher Education Area and ensure quality levels corresponding to the requirements of this space and remain competitive at European and international levels;
- Institutional responsibility: the quality assurance management and responsibility fall under the competence of each accredited higher education institution, in conformity with academic autonomy;
- Institutional diversity: the diversity of the institutions, of their missions and objectives is respected and encouraged by means of the external evaluation of quality;
- Cooperation with all components of the educational system: the approach, the implemented practices and the forms of technical assistance offered by RAQAHE are based on cooperation and mutual trust in its relationships with Higher Education institutions and other partners;
• Focus on results: the results of learning and university research performance – seen as a component of the education process – hold the central reference position in quality assurance and evaluation;
• Institutional identity: learning and research results and performance can be achieved through a variety of practices, methods or structures, autonomously designed and implemented by each institution, according to its own options. In this respect, the most important weight, in the evaluations made by RAQAHE, is given to results and performance, without neglecting the influence of good practices and successful structures in the field of academic quality;
• Internal institutional self-evaluation of quality: each self-evaluation document must present the specificity of the quality culture in the higher education institution and ensure continuous performance improvement;
• External evaluation: external evaluation is based on the higher education institution proving its learning and research results and performance and the verification of their relationship with stated institutional reality, including the verification of student activity, against the stated standards;
• Improvement of quality: the permanent improvement of quality and its institutional management represents the main objective of the external evaluation.


Their aim is to promote that quality culture which will consistently contribute to achieving a quality higher education, defined as a public good, worthy of public trust and which is defined through the following criteria:

A. Institutional capacity, as a measure of the internal organization and management, of the infrastructure available and which is defined through the following criteria:

a) the equipment and assets made available;

b) the institutional, administrative and managerial structures;

c) the human resource.

B. Educational effectiveness, which refers to the mobilization of resources with the purpose of attaining the expected training output, and that entails the following criteria:

a) the contents of the training programs;

b) the training output;

c) the scientific or didactic research activity, as the case may be;

d) the financial activity of the organization.

C. Quality management, referring to the following criteria:

a) strategies and procedures for the purposes of quality assurance;

b) procedures related to the initiation, monitoring and regular review of programs and activities carried out;

c) objective and transparent procedures to assess the training output;

d) procedures for the regular assessment of the trainers’ quality;

e) accessibility of the training resources;

f) systematically updated database on the internal quality assurance;

g) transparency of the information of public interest on the training programs, and on the issued certificates, diplomas and qualifications, as the case may be;

h) operation of education quality assurance structures in the conditions set forth by the law.

These three fundamental areas of quality assurance in education must be taken into consideration for the organization and functioning of an organization which aims to become or already operates as a higher education institution.

Criteria address each of the three areas stipulated by Law and represent the fundamental aspects of the organization and functioning of an education providing organization. Each criterion is linked to a set of standards. The role of the standards is:

• to guide institutions in their self-evaluation of quality in order to independently assess their own results and performances, and to identify the areas in which they should correct or improve their performance;

• to provide a framework for the elaboration of institutional self-evaluation reports;

• to provide the basis for external evaluation;

• to establish a common framework of reference for quality assurance and accreditation.

Standards (S) are formulated in terms of rules and outcomes and define the minimum compulsory level of achievement of an activity. All standards are formulated in general terms, in a statement form, and are expressed in sets of performance indicators. Standards are differentiated by areas and criteria.

The Standards of Reference are those standards which define the optimal level of achievement of an activity by an education providing organization, based on existing national, European or international good practice. The Standards of Reference are specific to each study program or institution, they are optional, and are set above the minimal level. The Standards of Reference can vary from one institution to another, and it is possible that, over time, institutions formulate their own Standards of Reference at higher and more competitive national and international levels. The level of a Standard of Reference is made by comparison with a Standard, and, within the latter, by comparison with the optional levels of the performance indicators.

A Performance Indicator (PI) represents an instrument for measuring the level of accomplishment of a certain activity carried out by an education providing organization against a standard. The performance indicators identify those outcomes which vary from a minimum acceptable level (Min) to a maximum identifiable level (Ref 1, Ref 2, etc.) I. The minimum levels of performance indicators correspond to the requirements of a Standard. The maximum levels correspond to...
Standards of Reference, are optional, and differentiate the quality of an institution both hierarchically and progressively. The correlations and the hierarchical relationships between areas, criteria, standards and performance indicators are presented in Figure 1.

Criteria, standards, and performance indicators apply to quality assurance and accreditation. These are used by higher education institutions and by RAQAHE as follows:
(a) they represent the reference point for quality management in higher education institutions;
(b) they offer the framework for collecting information and maintaining databases which institutions can use for internal monitoring and external demonstration of academic quality assurance;
(c) they are used by RAQAHE in the process of external evaluation and assurance of quality, for the purpose of accreditation and development of a quality culture.

2.2. Area B: Education effectiveness

Every higher education institution organizes its teaching activities in terms of learning outcomes and its research activities, by taking as a reference point its performance in developing and transferring knowledge and technology. This academic quality evaluation area addresses the teaching, learning, and research processes and their outcomes, in order to establish the level of education effectiveness.

Criterion B.2 – Learning outcomes

S.B.2.1 – Validation of academic qualifications

The knowledge, competences and skills acquired by graduates are sufficient for them to integrate into the labour market, to develop their own business, to access to the next study cycle and to continually learn and develop.

PI.B.2.1.1 Validation by employability within the field of the academic qualification

Min: At least 20% of the last two series of Bachelor graduates are admitted to Master’s programs, regardless of the field of study

Ref. 1: At least 50% of the last two series of graduates are admitted to master programs, regardless of the field of study.

PI B.2.1.3 Level of students’ satisfaction with regard to their professional and personal development ensured by the higher education institution

Min: More than 50% of students appreciate the learning/personal development environment offered by the higher education institution and its compatibility with students’ learning paths.

Ref.1: More than 70% of students appreciate the learning/personal development environment offered by the higher education institution and its compatibility with students’ learning paths.

3. RESEARCH SETUP

3.1. About LBUS

Nowadays, “Lucian Blaga” University of Sibiu is one of the most prestigious universities in the country, both in terms of quality teaching and technical endowment. The University of Sibiu has 11 faculties: Faculty of Theology; Faculty of Law; Faculty of Letters and Arts; Faculty of History and Patrimony; Faculty of Engineering; Faculty of Sciences; Faculty of Medicine; Faculty of Agricultural Sciences, Food Industry and Environmental Protection; Faculty of Economics; Faculty of Journalism; Faculty of Political Sciences, International Relations and European Studies, each providing both undergraduate and postgraduate study programs. Mention should be made that over 20,000 students coming from all over the country and abroad to study in Sibiu benefit from a high standard of accommodation which is continually improving.

One can single out as an illustration of the quality of education at University “Lucian Blaga” of Sibiu, the High Confidence rating that ULBS attained in 2009 (fig.2), following RAQAHE institutional evaluation.

3.2. The survey

The objective of the survey was to ensure an easy and rapid gathering of information relevant for graduates’ level of satisfaction with their academic qualification. Survey’s design

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<table>
<thead>
<tr>
<th>Areas of Quality Assurance in Education</th>
<th>Criterias in the mentioned areas</th>
</tr>
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<tbody>
<tr>
<td>A. Institutional Capacity</td>
<td>B. Educational Effectiveness</td>
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<td>C. Quality Management</td>
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<tr>
<th>Standards</th>
<th>Standards of reference</th>
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<tr>
<td>Standards – define the compulsory minimum level of accomplishment of an education activity</td>
<td>Standards of reference – define the optimal level of accomplishment of an activity by an education providing organization</td>
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</tbody>
</table>

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**Figure 1. Hierarchical Relationships**

**Figure 2. The LBUS certificate issued by RAQAHE**

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was intended to allow a simple and efficient analysis of the gathered information and an accurate interpretation of the results.

The questionnaire items were created starting from RAQAHE requirements for academic qualifications, considering the following quality indicators: PI.B.2.1.1 Validation by employability within the field of the academic qualification, PI.B.2.1.2 Validation by access to the next level of academic studies, PI B.2.1.3 Level of students’ satisfaction in regard to their professional and personal development ensured by the higher education institution.

The items content aimed at evaluating the following variables:

- current employment status of the graduate students;
- length of time period between graduation and employment;
- overlap between university qualification and the current professional position;
- percent of the graduates entering a master program;
- satisfaction level with the professional and personal development ensured by LBUS;

The survey was applied starting with 2007. The application methodology has considered the following aspects:

- the required data from graduate students should be acquired in a easy and fast manner;
- the difficulty of contacting the graduates after the completion of their studies;
- the graduates came to university approximately one year after graduation to receive their diploma;

Considering all these aspects we decided that the most suitable solution for performing the survey would be to distribute the questionnaire within Diploma Department when students come to receive their diploma.

At the LBUS - Quality Assurance Department we developed a database for collecting, analyzing and interpreting the questionnaires results. The database was organized so as to comprise all the LBUS faculties and study programs, in order to provide a comprehensive image on the academic qualifications our university offers. For a more accessible analysis of the results we generated also graphical representations of the information gathered through questionnaires.

We need to emphasize that the evaluation process of academic qualifications is an ongoing activity and the results we will present as follows are just preliminary. The data collected through questionnaires were a subject to a quantitative analysis in order to answer RAQAHE’ quantification requirements of “Validation of academic qualifications”.

The results of the survey performed so far suggest that the academic qualifications LBUS provides meet RAQAHE standards regarding: graduates’ employability, the overlapping between university qualification and the current professional position, percent of the graduates entering a master program, satisfaction level regarding the professional and personal development ensured by LBUS. We need to mention that these results reflect a global quality level of academic qualifications at LBUS, but the situation may be different if we perform a detailed analysis at the level of every study programs.

Detailed results of the survey are further presented.
4. CONCLUSIONS

Every university must offer an educational system that meets the standards of the three fundamental areas of quality assurance in education: institutional capacity, educational effectiveness and quality management. In order to evaluate the extent to which these standards are achieved we need to elaborate assessment instruments. At the LBUS level such instruments were created and have already been applied. The results gathered so far suggest that this is an efficient evaluation tool for the assessed quality indicators.

5. REFERENCES

1. Law no. 88/1993 on Accreditation of Romanian Higher Education Institutions and Recognition of Diplomas.
2. Law no. 87/2006 for enforcing GUO no. 75/2005 regarding assurance of education quality.
THE FUTURE EUROPEAN CO-OPERATION IN EDUCATION AND TRAINING

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ABSTRACT: Since the 2008 Spring Council underlined the necessity to attract more adults into education and training, there has been a slow progress towards meeting the established benchmark of 12.5% participation in adult learning (achievable in 2017). The goal of this paper is the presentation of the potential education and training five European benchmarks for 2020 and the Romanian comparable results. That means the adult participation in lifelong learning, low achievers in foundation skills, language learning, investment in higher education, promoting equity and citizenship. These benchmark areas are relevant in European and national education policy and, the elaboration of the National Qualification Framework is very close related to them. Starting from the table of the participation in lifelong learning trends in Member States and comparing with the results in Romania, in the paper will be done an analyse of the internal causes of the huge difference and they will be identified some solution.

1. INTRODUCTION

The current downturn underlines that by 2020 there will be more and different jobs in EU that there were in 2006 (with other contents and other structure). In 1996 31% of jobs needed low level or no qualifications, but in 2020 the proportion is expected to fall to around 18% [1].

Europe has around 78 million (a third of its workforce) with no or only the lowest level of qualifications. At the meeting in Bordeaux (November 2008) the ministers responsible for vocational educational and training together with the European Commission and European social partners underlined that investment in skill development remain paramount. For this reason, this period should be seen as an opportunity not only to restructure the economy but also to find ways for people to renew their skills throughout their working lives.

2. VOCATIONAL EDUCATIONAL TRAINING (VET) BEYOND 2010

VET is undergoing systemic change strongly supported by European policy cooperation, and has a crucial role to play in Europe’s effort to raise the skills of its citizens.

In spite of all the efforts, the barriers to lifelong learning for adults and older workers still need to be brought down; more people needs to be attracted to VET, demographic change points to a substantial fall in VET graduates. The skills and competencies needed by adult education professionals are based much on the andragogy than on and the pedagogical discourse. The competencies needed more specifically by leaders of adult education institutions the focus have to be shifted to issues such as programme planning and organisational management [5], and policy too. The conditions under which the adult educators operate and which contributes to determining the role and functions of the professionals are widely created by the policy. A prerequisite for being able to optimise one’s professionals action in the given policy context and to plan and act in the forward-looking way in order to enhance both the demand and supply of adult learning opportunities is a good knowledge of modern policy approaches.

Innovation is considered to be one of the main drivers of regional growth, of the development of human resources, entrepreneurship and welfare. Innovation is not a goal in itself, but a means for achieving growth policies and for achieve these goals there must be harmony between lifelong learning policies, employment policies, research and economic development policies.

There are two main reasons why innovation policies need to be combined with those related to lifelong learning:

- LLL is the policy that ensures a knowledge base for innovation, as well as the presence of innovative people;
- It is possible to ensure the existence of a learning network that acts as a sub layer for every type of partnership for innovation.

The future is characterised significantly by uncertainties that is more evident from the recent global financial crisis. Uncertainty, caused by socioeconomic factors and changes has a major impact on VET development, pushing for modernisation (the reactive way). Research shows that it can also become a driver of success and competitiveness for European economies and societies.

Most countries consider current policy priorities also valid for the future, both at EU and national levels. All countries’ policy strategies for VET are often aligned to the programming period of the structural funds (go beyond 2010) and their policy agendas are thus stable in the coming years.

The policy objectives on this topic are:

- perennial specific objectives such as:
  a) developing adequate methods and support to put outcome-based qualification frameworks into practice, applying outcome-based curricula and, in particular, assessing and validating skills and competences;
  b) increasing flexibility and permeability of paths; mainstreaming validation of non-formal and informal learning;
  c) skills development for disadvantaged groups high on the agenda with focus on:
    - preventive policies to keep learners in education and training;
    - remedial measures to make up for deficits;
    - more opportunities for adults to upskill in particular low-qualified;
    - intergenerational learning.
d) making VET more attractive by improving its quality. Finding the right balance between trust and control and between excellence and equity;
e) developing teachers’ and trainers’ competences;
f) anticipating future skills, better information on enterprises’ skills;
g) support structures and methodologies to cater for learners with migrant backgrounds: integration through VET; educational and guidance personnel with migrant backgrounds; linking skills acquisition to language learning; integrating European tools into integration policies;
h) more cooperation across educational sectors, in particular between VET and higher education, as boundaries are blurring. Unified or at least coherent qualifications frameworks and consistent credit systems are considered long-term aims;
i) improved foreign language skills and recognition of acquired competences to increase cross border and interregional learning; introduce an accepted pan European training ID card along the lines of the student ID card;
j) need and development of common references or common European profiles for core occupations;
k) better governance at all levels, based on autonomy, accountability and learning partnerships and efficient allocation, equitable distribution and sustainability of national and EU VET funding.

• focus on skills;

Up-skilling of adults has been identified as one of the pressing perennial issues. In spite of the increasing access to education and training for those with less opportunity in the last three years, statistical evidence points to persisting inequity.

VET research should have a key role in identifying how to engage adults in the workforce in training. In the next decade, new VET research will be needed to:

- establish what skills older people will need to develop and how work organisation can accommodate their needs;
- identify how to meet the changing needs of migrants (first, second, third generation of migrants);
- analyse social inequalities between diverse groups of young people across Europe, related to opportunity costs of education and the economic capacity needed to support changes in economic activity during full-time education
- find ways to promote education and training for women entering and re-entering the labour market establishing gender equality.

3. BUILDING SYSTEMS FOR EARLY IDENTIFICATION AND ANTICIPATION OF SKILL NEEDS

In Europe our days there is a trend towards a holistic approach in identifying skill needs, but the methods vary a lot. It can be distinguished the following approaches:

- quantitative and semi-quantitative (economic forecasting models, surveys among employers, skill audits)
- qualitative (Delphi method, case studies, focus groups, sector scouting and determining qualification requirement among trendsetting companies)
- combined/holistic approaches- foresights, shared diagnosis, scenarios, observatories (sector, regional)
- others (sector studies, alumni surveys and monitors, specific branch/type of activity/occupation/field of qualification studies, studies on skill requirements for specific target groups (unemployed, disabled, low/non-qualified, ethnic minorities, foreign workers).

<table>
<thead>
<tr>
<th>Low achievement in reading</th>
<th>Early school leavers (%)</th>
<th>Youth attainment (%)</th>
<th>Mathematics, science and technology graduates % Increase</th>
<th>Share of females</th>
<th>Participation of adults in LLL (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU</td>
<td>21.3</td>
<td>24.1</td>
<td>17.6</td>
<td>15.2</td>
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<tr>
<td>UK</td>
<td>12.8</td>
<td>19.0</td>
<td>18.4</td>
<td>17.0</td>
<td>76.4</td>
</tr>
</tbody>
</table>

4. COMMENTS

1. Comparing of EU’s and Romania’s percents it results that the low achievement in reading is double in Romania and it is the biggest at the European level! Having over 50% of adults with low achievement in reading, the situation is very dramatic! Even in Bulgaria the situation is better!

2. The situation is better for the early school leavers, but Romanian percentage is still over the EU’s percentage and it is diminished too as in Europe! They did a lot of efforts in this direction by and the project PIR done by World Bank together with the Romanian Ministry of education is a good example for this. In spite of all these, one of five children is still out of the classrooms and again, in Bulgaria the situation in better!

3. For youth attainment Romania is not on the last position and the tendency is to increase, as in EU! In Finland and Estonia could observe the decreasing tendency.

4. “Mathematics, science and technology graduates” offers to Romania a very good position! The second position remains if the benchmark is done with al EU countries. The explanation is the interest of the young people for computer science and the distribution of the budgeted place.

5. “Mathematics, science and technology graduates” offers to Romania a very good position! The second position remains if the benchmark is done with al EU countries. The explanation is the interest of the young people for
computer science and the distribution of the budgeted place.

6. Related to the Participation of adults in LLL, in 2000 the ratio between EU’s and Romania’s figures was 8 (!) in 2007 the ratio decreased to 7(!), but it is not acceptable the slowly integration of adults in Adult Education field. An explanation is the fact that in Romania the non-formal education was not considered as education before 2007! For these reason the Romanian figures are not very accurate. In the National report of Romania for CONFINTEA VI the figures are more realistically, but there is still an important difference between Romania and EU.

7. The common problems reported by Member states in EU could be identified in Romania too:
- lack of coordination of different activities and difficult access to the information;
- time lag between producing analyses detailed and robust and incorporating the knowledge into VET courses;
- insufficient flexibility and capacities in education and training institution to transfer the information on labour market needs into study programmes;
- inadequate funding (although ESF contributes significantly)
- insufficient human resources and expertise;
- insufficient statistics collection and database development;
- resistance and inactivity of employers in identifying skill needs.

5. EUROPEAN APPROACHES

In 2000 was adopted the Lisbon strategy who set the ambitious objective “By 2010 the European Union will become the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth, with more and better jobs and greater social cohesion. Apart from sound macroeconomic conditions, knowledge was regarded as a crucial factor to guarantee Europe’s competitiveness (learning economy”). From 2008 to 2010 more emphasis is placed on social objectives, who require inclusive education and training policies and coherent lifelong learning strategies. Education and training 2010 work programme of the European Commission is a framework of cooperation between Member States in education and training towards achieving the Lisbon goals. National support for these reforms includes a framework of key competences needed for the knowledge society, the European qualifications framework, Europass, ECT, Lifelong learning, end others. AQ very important part consists of training of trainers and continuous education of teachers.

6. THE PROFESSIONAL DEVELOPMENT ABROAD: TRENDS AND STRATEGIES

One of the key structural supports for teachers engaging in professional learning is the allocation of time in the work day and week to participate in such activities. In most European and Asian countries, instruction takes up less than half of a teacher’s working time. The rest (about 15 to 20 hours per week) is spent on tasks related to teaching, such as preparing lessons, marking papers, meeting with students and parents, and working with colleagues. Most planning is done in collegial settings (a large faculty room where teachers’ desks are located to facilitate collective work) during meetings on subjects-matter departments and small grade-level teams. Among OECD nations more than 85% of schools in Belgium, Denmark, Finland, Hungary, Ireland, Norway, Sweden and Switzerland provide time for professional development as part of teachers’ average work day or week.

On this way, their learning activities can be ongoing and sustained and can focus on a particular issue or problem over time. Similar practices are common in Japan, Singapore, and other Asian nations. In South Korea, for example, only about 35% of teachers’ working time is spent on classroom instructions and devote non-classroom time to collaborative planning, lesson study, peer observation and research.

By contrast, U.S. teachers generally have 3-5 hours per week for lesson planning, usually scheduled independently rather than jointly with colleagues. They spend about 80% of their time of work[3] in classroom instruction (comparing with 60% for other nations).

In Japan, research lessons are a key part of the learning culture. Periodically, every teacher prepares a best possible lesson that demonstrates strategies to achieve a specific goal in collaboration with colleagues. The lesson is usually record (videotapes, audiotapes), the number of students who volunteered is indicated. After analyses and discussions, sometime the revised lesson is given by another teacher only a few days later, and it is observed and discussed again. Some research lesson are provided for local public, and principals, district personnel and policymakers could attend and see how teachers are grappling with new subject matter and goals.

7. BOLOGNA PROCESS

Romania, one of the Latest EU Member state (being a member since 2007), implements Bologna process (BP) since 2005 (the specific low was done in 2004) through all its universities. For teacher education, after BP, they are three levels university degree, but it has been rather “complicated” process.

It is appreciate that Bologna process without connection with European qualification framework means nothing. The BP for Romanians means not only the reduction of study length, but it also means a connection with EQF. The university degree means nothing if it would not be explained at the level of the competences profile, vocational profile, and learning outcome, that every thing should be prepared for every cycle, every degree and every discipline.

The first phase of the implementation of the Bologna process was at the level of the universities and the second phase was at the level of the social community especially at the level of the labour market which must recognise new qualifications, new competences, and new learning outcomes.

Before BP, the main requirements for pre-school and primary school teacher education is a Bachelor degree. This was well organised and was a traditional feature of the Romanian system. This system seems to be great by assuring professionalism to this category of teachers.

Our days, in Romania, teacher profession is not very attractive. Most popular are sciences like medicine or engineering, or to be a lower or even an actor, after them comes teacher profession. The reasons are: salaries are not competitive in comparison with other professions, moral and social prestige is not very high and nobody is qualified as a subject teacher! For this reason, the selection of teacher students to Teacher Education departments usually using an interview it is not very strict.

In order to implement all the recommendations communicated by the Commission regarding Teacher education, after 2005 was developed a national TE strategy in which the initial
teacher education interferes with continuing professional development. The weak points in Romanian TE system are: the lack of an induction process (present now only in the papers), the lack of mentors, the necessity to create the connection between initial education and continuing education (between ECPT and CDP). Also the evolution inside the teaching career is complex, traditionally there is a national exam (called definitivat) named definitive degree. In order to assure a career promotion, it is compulsory to build a connection by induction stage, because the duration of studies, after Bologna process, decreased and the general level of education of the secondary schools graduates is lower than ten years ago. But the problem is to identify the way for becoming a mentor.

All the problems mentioned before have now answers and solutions: using the European Social Founds they are developing the following structural projects:

- the elaboration of the occupational standard “for teacher of teachers”, coordinated by ARACIP (Romanian Agency for Quality Assurance in Pre-university Education);
- the elaboration of the occupational standard for mentor and the identification of the way for having this job, coordinated by the direction of MECI in charge with the integration of the university study’s graduates in the labour field;
- the set up:
  a) the network of the didactical functions and the set of the necessary competencies for each of them,
  b) of the qualification of the teacher (described by the level of knowledge, skills and competencies) and the five occupational levels (teacher for pre-primary, for the primary, for the secondary school, for high schools and for VET education),
  c) one compatibility among ECTS (European Credit Transfer System) and CDP (Credits for Professional Development), coordinated by CNFP (National Centre for Staff Training in Pre-university Education).

8. CONCLUSIONS
1. The professional development and the quality of teachers and trainers have been recognised as a priority in various European policy documents in the field of lifelong learning (Education and Training 2010, Copenhagen process).
2. In spite of these, the initiative that been taken to improve the professional situation of teaching staff have so far concentrated very much on school teachers.
3. For the large groups of teachers who work with adult learners, especially outside the formal sector the situation is completely different.
4. To achieve both a quantitative expansion and a qualitative improvement of adult learning activities well-qualified staff are needed to support adults professionally in their learning.

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APPLYING OF INNOVATIVE TEACHING METHODS IN THE MARITIME ACADEMIC

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ABSTRACT: Training process in maritime field has two major components designed for the development of theoretical and practical knowledge and skills, offering graduates a double qualification at the end of studies as maritime officers and engineer in transportation. This option of having double qualification and also the possibility to activate in many connected fields involves a complex teaching and training process that uses new and advanced technology as simulators, computerized programs and interconnections with economical sectors. Present paper describes the way of using these new teaching methods in maritime educational system in order to provide better specialists at an international required level for maritime transportation field and connective business sector. The results obtained at Maritime University in Constanta have shown, in accordance to international statistics, a decreasing of collisions in simulated environment with over 60 percents that will considerably improve safety on sea extrapolated in real conditions.

1. INTRODUCTION

During time, maritime transport has suffered many changes, most of them technological, made for only one purpose, to increase safety on sea. Making these changes operative presumed new equipments on board ships and these equipments required new competences and knowledge.

The development of new competencies for people involved in maritime industry, especially those with responsibilities on safety, supposed a whole restructure of training system, including the academic level. In the last decade it have been made important steps in this way, like improving techniques in academic training system or adding the latest technology for this purpose – different simulators, operational computerized programs and, most important of all, curricular changes according to economic requests.

In deep connection with technological changes and developments, it was necessary to prepare the teaching staff at newly imposed standards and to update old teaching practice, including latest training technology. So, it was necessary to train the trainers or to bring new specialists inside the system. In both cases, for older and new trainers, there have been implemented programs for familiarization and update to the new requirements.

All these changes collaborated with the possibility to obtain a double qualification at the ending of studies and implicitly with multiple possibilities to find a job, transformed the maritime field in an interesting one for many young persons, fact proven by the increased number of students in the last years.

Applying the innovative teaching techniques leads to an increasing in safety also in on board activity. Statistical reports performed by specialized institutions in the field have shown a reduction of incidents caused by the lack in understanding the latest technology used in the navigational process and in familiarization with it during training process.

The use of new technologies and techniques in the maritime training process allows trainers to generate abnormal situation that can be encountered during activity on sea, but are difficult to be described through classically training techniques. In this context is easier to understand what means a crisis situation and how to deal with this.

In the same time, the simulation techniques used for training on ship handling simulator and engine room simulator allows the future maritime officers to know exactly which will be their future duties on board ships, allows them to see what errors or mistakes can be made and offers them possibilities to find better solutions for solving these problems, accepting the idea that is better to make a mistake in a simulated environment than in reality.

2. THE TRAINING IMPROVEMENT AND ITS RELATION WITH THE NEW TEACHING METHODS

In the present days, the computers and computerized programs are part of the life of many people. The computerized technologies are becoming indispensable for many activity fields, computers being part of the educational processes, or even the essence of these.

Various technologies as simulators, computerized programs and many types of virtual learning as web platforms and virtual campuses are used today for training purpose in the maritime academic field.

All these have their own history and evolution, some faster, others in time, but all, as single or combined, help to reach the final goal, better trained seafarers for more and secure oceans.

From all these training procedures, the first were the specialized training programs, based on computerized technology and used mostly for designing and studying of different processes. Being the pioneers, these programs did not have a very expressive way of revealing the results and in fact, the procedures for obtaining these results were difficult. Having a poor data base, it was necessary for applications to know the entrance data and all usable variables as user. During time, these programs have been improved and in short time they became indispensable for training courses regarding ship design, engine design and engine internal processes, and liquid
cargo transfer or in situations that request a deep study of thermal and tensional processes inside of different parts of ships body.

The next step in the technological development of the training process has been marked by the advanced computerized programs, more complex, with a more realistic presentation of processes and operations - the simulators. Basically, the simulators consist of computerized programs, but the graphical expression is more evaluate, the images offered are closer to reality and in this way, they allow to the user to interpret easier the information.

The use of simulation in providing solutions to the problems of risk and crisis management and the optimal use of crew resources has a long established pedigree in maritime training (Barnett at al., 2002).

The early simulators consisted of real radars, located in a set of cubicles, and fed with simulated signals. Individuals or teams could learn the skills of radar plotting under the guidance of an instructor working at a separate master console. Other navigational aids in the simulator were fairly basic and certainly did not include a visual scene.

Bridge simulators with a nocturnal visual scene made their appearance later and allowed teams to conduct simulated passages in a realistic environment but with only a few lights available to indicate other vessels and shore lights.

Simulator-based training courses were introduced primarily to train the skills of passage planning and the importance of the Master/Pilot relationship (Hensen, 1999). This training initiative developed into the Bridge Team Management courses that are conducted today on many simulators world-wide and contain many of the elements to be found in Crew Resource Management courses developed in other industries, such as aviation. These courses were developed to focus on the non-technical skills of flight operations and include group dynamics, leadership, interpersonal communications and decision making.

Bridge Resource Management courses are a more recent initiative, adapted directly from the aviation model for training the non-technical skills of resource management, and is not always based on the use of simulators.

The 1980s saw the introduction of Engine Room simulators and towards the end of that decade, cargo operations simulators also became available. These types of simulator have primarily been used to train officers in the handling of operations, including fault finding and problem diagnosis, and increasingly to train teams in the skills of systems, resource and risk management.

Many types of simulator: bridge, engine and cargo control room, have tended to emphasis a physically realistic environment in which these exercises occur, although of the PC-based simulators for training some tasks is increasingly widespread (Peterson, 2002).

In some parts of the world, it have been developed simulators which have very high levels of physical fidelity, for example, multi-storey engine room mock-up and bridge simulators including features such as 360 degrees day/night views, pitch and roll, full vibration and noise effects.

The only mandatory requirements in the maritime domain for the development of the non-technical skills of crisis management are those of the International Maritime Organization’s (IMO) Seafarer’s Training, Certification and Watchkeeping Code (International Maritime Organization, 1995). Table A-V/2 of this code specifies the minimum standard of competence in crisis management and human behaviour skills for those senior officers who have responsibility in emergency situations.

The simulators used in the maritime officers training are a compulsory request of the STCW Convention and Code in order to assure an increased safety of maritime activities.

The competence assessment criteria detailed within the Code are not based on specific overt behaviours, but rather on generalized statements of performance outputs, and as such are highly subjective and open to interpretation.

Although these standards of competence indicate that IMO recognizes the need for non-technical management skills, both the standards and their assessment criteria are immature in comparison with the understanding of non-technical skills, and their assessments, within an industry such as civil aviation.

The use of simulation and modelling in the innovation cycle demand a higher degree of flexibility in simulation technology than required for the training function. Simulators need to be able to accept input from a variety of model data, and need to be able to interact with other simulators in unusual and unique situations.

Open systems with modular and recyclable components are required in order to mobilize the boarder academic, scientific, engineering and corporate communities to integrate simulation and modelling into the innovation process.

At the end, but not the last, the technology used in the present training process uses the virtual techniques through its components as on-line teaching and web based applications.

The incorporation of the elements of information and communication has been highly accepted and renowned as valuable aspects in the formation process of engineers and technologists.

The advent of on-line technologies coupled with an emerging recognition of the importance of effective teaching are acting together as catalysts to change the face and nature of teaching and learning across all sectors of education. Significant changes appear to be emerging in higher education and in many components of school education. Through on-line technologies, we finally appear to have the means to create the forms learning environments that we know work best. The classroom of tomorrow is starting to emerge and it is quite different to the classroom to which many are accustomed. Perhaps the most noticeable difference is in the roles of the participants. Everyone seems to have to do things a bit differently (Oliver, 1999).

On-line learning can be an active and engaging experience. There’s not much room for spectating in a well-designed on-line learning environment. Students are encouraged to collaborate and work together. The environment is usually one of a shared learning space with learners attentive and receptive to others in the class.

Move to on-line is coinciding with moves to more authentic learning settings. The on-line technologies encourage and support such strategies as problem-based learning, case-based learning and even work-place learning. The concept of a classroom as a place of learning is expanded as the classroom loses it boundaries (Oliver, 1999).
Learning on-line encourages and supports the development of a range of students’ key and generic skills. There are many useful skills that can be developed through networked learning including information literacy, task management and working with others. Learners become self-sufficient and cognizant of their own role in influencing what is learned. It’s all about whom takes responsibility for what is learned.

As educational systems move to embrace new environments and new roles for learners, all with the learners’ best interests in mind, teachers and administrators must be aware that change processes are complicated and often fraught with difficulty. Many learners are often not prepared for willing to be self-directed and independent just yet (Boote, 1998). Learners often need to be encouraged and induced into the changed roles and need to consulted and negotiated with to gain their cooperation and consent (Oliver, 1998).

3. ANALYSE OF INNOVATIVE TEACHING METHODS APPLIED IN THE MARITIME ACADEMIC TRAINING FIELD

The use of the latest technology during the training process in maritime field has a good impact on increasing safety and security over seas. This impact, as results of training, is seen in time and evaluated from feed backs received from companies where graduates work after finishing studies. Other modality to evaluate the impact, as general evaluation, is represented by the reports of international organizations regarding safety on sea and from them to extract the percentage represented by our graduates. Anyway, using one or other way for finding the impact of the latest technologies used for training, the result is comparable, these technologies proving their role in the most important aspect on sea, increasing of safety.

These evaluations are used for maritime transport sector, where graduates work as ship officers, for rest of graduates who work in connective activity domains, as port operation, ship operations and others, and the evaluation feed back is provided mainly by the companies.

Beside of these evaluations provided by the independents and also beneficiaries of the training results, our university, as maritime trainer provider, have designed its own evaluations, made during studying years and after graduation.

In this way, computerized programs specialized for ship designing and study of ship hull resistance, as AutoLoad, AutoHydro and Model Maker, help our students to understand easier the tensional processes developed inside of a ship hull for different loading conditions or during different stages of sea rough. To know the effects caused by the over tension of ship hull structure is very important for the next step, where are implemented knowledge about cargo loading on board, stowage of these and preparing of a good cargo plan in order to have a voyage without problems of ship stability.

These programs have an important role for the future ship building engineers or graduates interested to work in a shipyard or for shipping companies as ship surveyors. For a good activity in these jobs is important to anticipate what efforts will be generated in the ship hull and how these will affect the structure and the integrity of the hull. Another important application of the knowledge received during training with these programs is given by the possibility of a right ship load as port operator, as responsible person with cargo loading and expedition.

The maritime statistics show a large number of ship accidents as capszizing or sinking caused by the deficient loading of ships, completely ignoring tensions in the hull or not enough studying them according with the sea state during voyage. More tragically is that these types of accidents have human casualties and for protecting human life on sea in these situations, one must know what can happen in case of over solicitation of ship structure.

In the same direction, now are used loading simulators, especially for specialized ships, as oil and chemical tankers and gas carrier ships. Based on information about ship structure behaviour for different loading conditions and using simulators after, can be completed the training related to ships operation.

During simulated exercises students have the possibility to operate different types of cargo, with different characteristics and, most important, different grades of risk. This training offers possibility to become familiar with the future real operations onboard of these ships.

For officers who intend to work on board all types of tanker ships is compulsory to provide special training.

Making an analyse of the results after training with and without technology in line of ship operation, mainly loading operations, we observe an increasing level of knowledge and skills at students that complete this training using simulators and computerized programs. Also, their professional evolution onboard ships can evolve successfully, considering them able to get a more rapid accommodation to ship equipments designated for cargo operation.

Regarding graduates that are choosing a career on a tanker ship, the feed back from owning company shows an increased compliance at the requested duties in case of those trained on simulator and who have a complete package of familiarisation and specialization courses.

In the navigation field, the main technology used for training is represented by the ship handling simulator and crisis management simulator. Both of them have important roles in the safety area, basically helping the trainee to realize a safety ship navigation, second to protect the environment in case of maritime disasters, as ship collisions followed by the oil pollution.

The classical training for avoiding collision supposed the use of plotting paper for calculation of optimum avoidance manoeuvring. Today, the simulation techniques allow not only to calculate and deduct the right avoidance manoeuvring, but also to live this manoeuvring. This possibility offers a way to understand exactly what presumes such a manoeuvre and to correlate the avoidance information with the ship handling procedures.

The practical results of this innovative method are represented by the decreasing of collisions in simulated environment with over 60 percents compared with the classical procedure.

In the real environment the results are almost comparable with the simulated ones, statistics being obtained from shipping companies that take our students as cadets or officers and also from our students from their own experience as cadets. Over 80 percents of returned students from their cadet practice revealed that the hours spent in ship handling simulators were very usefullly onboard and allowed them to be familiarized with ships bridge equipments, to react faster in different closer situations and to prove to their trainer officers their own level of competency.
Training on ship handling simulators gave better results for graduates, which after a number of years spent on sea, decided to work in the harbour pilot activities. For these, it is imperatively important to know how to handle a ship in small spaces as harbour basins and how to use correctly ships handling capacities.

Also, this training is requested in order to raise graduate’s interest to work in the vessel traffic control services, where is necessary for ship handling characteristics and capacities and to anticipate the dangerous manoeuvres.

Crisis management simulator has proved its utility through the reduction of cases of large oil quantity pollution or limitation of such pollutions. From their recruitment in the training process until today, the number of wrong actions in case of accidents with oil pollution has decreased with 40 percents due to a better knowledge of the indicated procedures and protocols applied in these situations.

Besides the training of future or actual maritime deck and engine officers, these simulators are usefully for training of emergency situation inspectorate personnel, which has to a better knowledge of the indicated procedures and protocols to perform different emergency situations involving commercial ships or other type of boats, for lives saving operations and help of a boat in distress.

In connection with online training, our university experimented this option inside of a course for familiarization training for petroleum tanker ship operation. In the online course, the students and already certified seafarers interested in attending a job on a tanker ship, have the possibility to visualize simulated applications regarding different operations necessary to be known on a tanker ship, after previous studying and learning the theoretical modules about these.

Analyzing the results of an year of training through this mode, led us to the conclusion that the students who attend this course have higher performances than those trained traditionally, the explanation relying in the open access from home or from onboard ship during their cadet practice or by the officers on duty on board.

In the same area, our university developed in time its own web based training system, where our students and former students can find necessary information’s as courses and applications.

This facility is very usefully in the distant learning concept, and taking into account the maritime work environment, this concept is very agreed by the present seamen who want to improve their skills and competencies in order to accede to a superior rank, to pass to ship officer position.

Almost 80 percents of the students included in the part time study cycle are accessing this form of courses provider, doing this activity during their onboard stages, in order to be ready for exam at returning home.

Using the online teaching techniques, the students or trainee have the possibility to access more courses in the same time, option to take all the information at one time and to cover the curricula in a shorter period than it could be done during regular classes.

The communication between trainers and trainees can be done through different ways, using the electronic correspondence or an open forum for general impressions and opinions. These communicative procedures can help the improvement of the present data and to generate the development of additional subjects with role of covering of missing data or usefully information’s for the principal courses.

4. CONCLUSIONS

The last years technological evolution imposes changes in the academic training system, more preciously it requests the inclusion of these technologies inside of training process as compulsory.

In the maritime academic training field, this necessity has been imposed by the working market which was interested to have better trained people and in the same time more competent for the new challenges provoked by the technological changes arisen on board ships. Not only the maritime field requested applying of innovative teaching methods during training, also connective activity fields, as port operators, traffic control and maritime business sector have shown their interest in use of the latest training procedures.

Applying of the latest technologies during training of future maritime officers, with applications in the connective activities will lead in time to a significant reduction of dangerous events on sea, as accidents or oil pollution, in percent of 40 to 90. Most important reduction has been already seen in the pollution area with direct result in the environment state, statistics of the last years showing only accidentally pollutions with small quantities without significant impact on the marine and shore environment.

Taking into account the already realized progresses based on the applying of the innovative teaching methods in the maritime academic field, we are entitled to consider as major importance the continuing usage of these technologies for safe oceans and normal environment.

5. REFERENCES