# NexusT Training Skills in Measuring, Acquisition and Data Processing

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***Abstract*— The main object of nonformal education, in the outlook of the European Council, is to promote equal opportunities for youth in the order that they should construct their own future, to offer support for their integration and inclusion into the society. One special object is the personal and social emancipation of the youth over the dependence and exploitation. The „nonformal education" is the expression similar to „work with youth" and/or „activities with and for youth" of social, cultural, educational etc. nature and refers, as a rule, to the domain of out-of-school activities. This paper presents the NexusT program, initiated at national level for young people who want to practice technical and scientific research.**

***Index Terms*— nonformal education, scientifical education, interdisciplinared teacher, curricula,**

## I. INTRODUCTION

The European Youth Forum defines the informal education as an organized educational process which takes place complementary to the formal education system, and do not absolute end with certificate. The individual participation based on voluntariate being defining inside of the no formal education, the youth plays an active role into the education process. It is always informed about what it learn, being involved into the process of planning, implementing, monitoring and evaluation activities. The no formal education offers to the children and youth possibilities for development of the values, abilities and competences – another than ones they develop inside of the formal education, as interpersonal communication and collaboration abilities, planning, creative problem solving and decisions taking, organizing and conflict management, off time organization, itself respect, order and responsibility.

The main object of nonformal education, in the outlook of the European Council, is to promote equal opportunities for youth in the order that they should construct their own future, to offer support for their integration and inclusion into the society. One special object is the personal and social emancipation of the youth over the dependence and exploitation. The „nonformal education" is the expression similar to „work with youth" and/or „activities with and for youth" of social, cultural, educational etc. nature and refers, as a rule, to the domain of out-of-school activities.

The most durable and efficient innovations are those such as the beneficiary assimilated, that is he adopted because its satisfy his specific needs. Let take into account that happen the concrete level with transformations produced by the new technologies of informations and communications:

Firstly, we observe the conversion of cultural content from all over the world into a digital form, thereby making the produces available everybody, everywhere and everytime. The wide area and high speed communication networks, connecting the computers from apartments or off student's desks to high capacity digital libraries, change the cultural conditions in which education developed. The loneliness is bygone and there take place a substitution of insufficiency and superannuation with the ampleness and arhisufficiency of its.

Secondly, there are developed multiple ways to represent informations, to simulate interactions and to express ideas, extending the aquisitions of inteligence, thus altering the spectrum of civilization, modifing the requirements of participation to the culture. The epistemological developing aquires interesting aspects. The thought relations closely with the language, the formal symbolizing from mathematics and logics being insighted as an extension of the various current linguistic aspects. The digital medium extends evidently the area, being used to aquire informations and to express ideas in different ways – verbal, visual or the combination of all these. As result, for educators will be more and more difficult to favour the operating of verbal language in detriment of the other expressing ways.

Thirdly, the people externalize various current abilities – to compute, to write correctly, to memorize, to visualize, to compare, to select – regarding the digital instruments with which they work, thereby obtaining a real mastership concerning these abilities, sometime results of education. The digital technologies amplify the individual potentials. The text procesors, for example, warn in case of any word written incorrectly or in case of grammatical errors, the worksheets allow everybody to make quickly and correctly calculations after extremely complex formulas, the data bases allow even to those with commonly retention to manipulate entire information suites. Other various forms of profesional working instruments reduce the aptitudinal level needful to participate effectively at a large area of cultural activities.

The Recommendations of the European Council for the member-states concerning the nonformal education aims at:

- transformation of the nonformal education/learning into a significant element of politics for younth and of european cooperation in this field;
- encouragement of the young people's engagement, implication and contribution at the promotion of one viable system of values;
- the programs of vocational forming and of permanent education, the systems of evaluation and counselling in education and career, the coaching and mentoring systems must allow for each young to choose the way throungh what it can reach the maximum potential and satisfy the

information and formation needs;

- support offering and development of research activities in the nonformal education/learning field and using of it's results;
- encouragement of accumulation and dissemination of the good-practice examples in the field of nonformal education/learning at the national and international level;
- guarantying/assuring of the human and financial resources enough for programs implementing and recognizing of their impact in the aim to allow for nonformal education/learning to occupy the adequate space inside of educational community.

## II. SUCEAVA NEXUS PROGRAM

The NEXUS-T program is elaborated to contribute at the young people's intellectual progress through direct implication in research activities, starting from ages of minimum 9 years. By interest stimulation of the pupils of gymnasial level together with those older the program proposes to generate the communication frame between different ages, to motivate the activity and the educational act of those small allowing the knowledge transfer between generations, improving the capacity of collaboration, of mutual aid, of work in teams with members having different or complementary training levels.

The NEXUS-T program proposes to structure an area dedicated to some extracurricular activities, intended in the main to state the reason for the interest for school in general and to allow certain training activities of the young people by extrapolation-research inside of some scientifical projects by which, the knowledge obtained into the classroom can be valuable and integrated into the *knowledge*.

Being joined the class of *nonformal education programs* and with a part of the objective alike to some similar international programs, as *Hands on Science*, *Design & Discovery*, the NEXUS-T brings as novelty an assembly consisting of:

- the Nexus room, space dedicated and equipped specific for documentation, courses, dialog and multidisciplinary assistance, the achievement of laboratory experiments. The activity in the room is developed on groups, structured around some themes selected by the Open Project base.
- the complex educational object (ODC) – hard/soft assembly which allows the experimental and multidisciplinar exploration of the processes and phenomena of interest, in accordance with the selected themes from an *Open Project*. ODC is projected so that to allow the creativity stimulation and formation of new abilities: attention, the capability to correlate the knowledge obtained during the course hours, initiative, spirit of collaboration and communication capability inside of some interdisciplinare teams etc.
- the accommodation program of the professors to the problems of the assumed *Open Project* – intensive courses (inclusive e-learning) dedicated to the assimilation of concepts and notions needful for infrastructure using, for curricula supplementing with novelties and for correlation between different elementary knowledge in sense of one integrative and multidisciplinare approaching.

Nexus-T-Sv has on the base a program-contract signed by:

- Center for Complex Studies from Bucureşti
- „Petru Rareş" Colege from Suceava
- „Ştefan cel Mare" University from Suceava
- Children Palace from Suceava
- Cygnus Scientifical Society – UNESCO center.


*ODC*

Fig. 1 The complex educational object

The 2007-2008 scholar year was a pilot year in which the program was tested and also the activities rhythm inside the curricula. Already had adhered at the program other unities from the country (Otopeni, Buzău, ...). At the end of the year 5 teams were registered of whom 3 from Suceava.

## III. NEXUS-T PROGRAM: TEAM STRUCTURE

The study teams were formed so that to include five young people with opening to different disciplines: *mathematics, physics, biology, chemistry, informatics*. Also it was desired the implication of the instructors from different circles and of some voluntary professors, with specializations on the respective disciplines. One can say thus about a mixed componence *professor-pupil/student* fact which lead to a better linking between the professor and pupil/student, respectively to a better interdisciplinare communication, essential inside the curricula for incorporation of the knowledge teached at the *Sciences* discipline. Those five professors component of the team cover the following competences: manager, experimentalist engineering, theoretician physicist, biologist-chemist. The team can be completed with members which to sustain the activity action and visibility and with technicians.

The teams were structured also an age categories: gymnasium (at the Children clubs level), highs cool and students. These teams interact and help themselves reciprocal at the possible levels.

## IV. NEXUS-T PROGRAM: THE OBJECTIVES AND CURRICULA

The NEXUS-T program objectives have on the base the development of:

- the attention to observe the developing of some experiments whose evolution is unknown initial (the capability to *contemplate* an experiment, to formulate questions, to formulate hypothesizes, to imagine an experimental protocol, ...);
- the patience in the effort to accumulate data from an experiment which develop during a longer period;
- the perseverance in documentation concerning the study domain;
- the synthesis capability in the structuration of one coherent material from the articles/experimental data base concerning the study theme;
- the capability to communicate with the team members,

with persons of different ages and trainings;

- the capability to communicate coherent and essentialized the obtained results inside one project;
- the managerial capability in organization and coordination of a concrete project, beyond the cumulating of knowledge specific to an education structured on disciplines.

Fig. 2 Images from NEXUS-T program

The program curricula contains:

- courses for initiation in the field of complexity, of data acquisition and its processing;
- the description of the equipments and of the available software for experiments;
- assignation of some complex experimental themes, graduated initiated, dependingon the teams training evel.

The curricula emphasis the:

- knowledge integration from diverse domains;
- study of the complex systems – generally on the alive and opened systems;
- practical applications, testing, experimentation, practical evaluation;
- computer using in data acquisition and controlling of some processes;
- digital data processing.

## V. THE TEMES DEVELOPED IN NEXUS-T 2009 AT SUCEAVA

A detailed presentation of the activities developed inside the Nexus-T program at Suceava in 2009 can be accessed on *www.nexustsv.ro*.

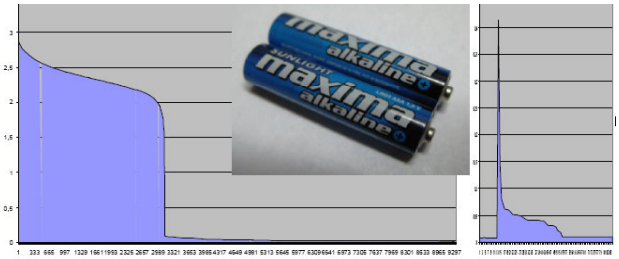


Fig. 3 The experimental determination of some usual batteries efficiency

**1.** The experimental determination of some usual batteries efficiency. There were tested different types of batteries through discharge by a consumer and data registration with a computerized acquisition system.

**2.** The influence of the physical factors on the human cardiac activity. As example, we enumerate some elements concerning this theme by the team 2:

Observations – The external physical factors have influence on the human cardiac activity. Different external stimuli seem to have different influences on the human cardiac activity, depending on its nature.

Hypotheses – The physical factors change the cardiac activity proportional (or not) to its intensity. It is possible that from the cardiac activity changing to decide which type of the physical factor operated. One can achieve a structure of etalon type for each stimulus type?

The experiment designing – The needful materials: geophone (vibration sensor), placed on the thorax of the tested patients, a data acquisition board connected to a computer with adequate software.

The working way – There are achieved measurements of cardiac rhythm of the patients which were informed concerning the different stimuli at which they will be putted to.

**3.** Study and analysis of a double pendulum by data acquisition over a cinematic experimental stand.

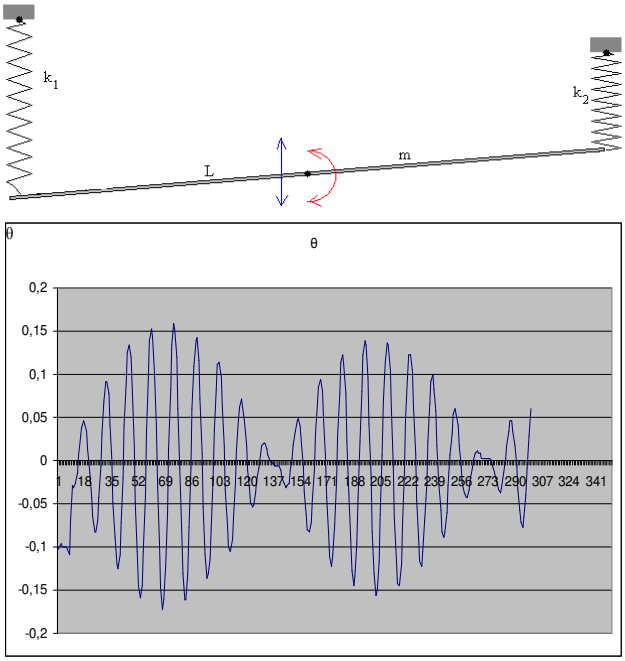


Fig. 4 The experimental determination of double pendulum

## VI. THE GENERAL IMPLEMENTATION STAHE OF THE NEXUS-T PROGRAM

- The complex evaluation of the pupils abilities and performances in the aim to identify a real reference of the abilities on which it can be structured a program of success (the abilities census);
- The evaluation of the professors' preferences, potentiality and availability to integrate it selves inside a nonformal education program, with prospects of financial autosuspporting;
- The elaboration of the NEXUS-T dedicated package, adapted to the specific features of the institution;

- Specific training for the professors group implicated inside the project;
- Installing of the NEXUS-T room;
- The selection of the pupils participant actively into the program;
- The controlling of the activities developed inside the NEXUS-T program and assistance offered by the program organizers, directly or by Internet;
- The final program evaluation: linking of institution to the NEXUS-T Network and selection of the participants for summer schools.

## VII. INSTEAD OF CONCLUSION

Fundamental research is an expression of human aspiration for world understanding, as well a source of some human aspirations on what should become the world.

The aspirations are desires for which exists in principle the possibility of some concrete achievements. The aspirations are the first step towards the materialization of „something" that exists only in spirit and that can become gradually the expression of spirit manifestation in physical reality. There are *own aspirations* and *aspirations* that have no sense unless its are common, if around its a sufficient number of individuals united by the same vision is closed. Only then a *functional project* is born.

Until an aspiration to become such a project it may be just a *state of spirit* translated into a *project proposal*. We called our proposals: „Projects opened"! In principle, under this designation are the themes:

- define the directions of permanent interest undertaken by partner institutions;
- search achievers and/or are currently infeasible, but may become active in the long term.

The Nexus-T educational system attracted young people through the practical nature and possibilities offered by the young participants to put their ideas into practice.

The complexity of the issues and the arised difficulties were overstepped due to the interdisciplinary nature which was at the base of the team's formation, each member being in a position to help by their own knowledge to the completion of the achieved studies.

Learning has in this program two gradients:

- the horizontal gradient allows each young from team to accumulate knowledge in its field of interest or at the its boundary with other fields;
- the vertical gradient refers to the levels at which the members forming the teams are: secondary school, highschool, university, teachers. Thus, each level can provide a support to the category with a lower knowledge base, helping quickly to understand and overcome some aspects of complexity. Teachers can call the specialists which support the project and work in major research and teaching institutions.

Therewith the program presents also two educational plans:

- a program corresponding to the familiarization of the young people that are part of the research teams with the approaching way of one topic of study, the experiment methodology and the presentation of experimental results;
- a plane dedicated for teachers familiarization with the teaching methods and techniques specific to this type of learning.

What next?

- To draw conclusions from previous work in preparing the future;
- To attract new teams, institutions, people longing to invest time, money and passion in this program;
- To start the program by age group (last year has worked only at the highschool level);
- To find new themes, actions, elements that highlight the work of the teams involved.

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