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DYNAMICS OF ROMANIAN HIGH SCHOOL EDUCATIONAL PROCESS AND EVALUATION METHODS USING VIRTUAL INSTRUMENTS

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Summary: *The paper presents the development of Bachelor's and Master's studies in Romania and especially in the University of Petrosani during the last years, before and after implementing Bologna's recommendations. Short history of the faculty, development of Bachelor's and Master's studies and the faculty itself is presented. Dynamics of students' number at the faculty shows changes in choosing study field and programs. Dynamics of Bachelor and Master Studies are presented and considered. Some possibilities to simulate representative data and a possibility to develop and to implement a virtual analyzer, as an electronic instrument, for detecting, in real time, the quality of the educational process by taking into account only some data like the presence and examination marks from specific exams and notations, in high schools, universities is presented as well.*

Key Words: *Bologna process, Bachelor's studies, Master studies, Virtual test method*

DINAMIKA OBRAZOVNOG PROCESA RUMUNSKIH VISOKIH ŠKOLA I METODE EVALUACIJE UZ POMOĆ VIRTUALNIH INSTRUMENTATA

Rezime: *Ovaj rad prikazuje razvoj diplomskih i masters studija u Rumuniji, a naročito na univerzitetu Petrosani tokom poslednjih godina, pre i posle implementacije bolonjskih preporuka. Kratka istorija fakulteta, razvoj diplomskih i masters studija kao i sam fakultet su predstavljeni. Dinamika broja studenata na fakultetu prikazuje promene u odabiru oblasti studija i programa. Dinamika diplomskih i masters studija je predstavljena i razmotrena. Pojedine mogućnosti za simulaciju reprezentativnih podataka i mogućnost razvoja i implementacije virtualnog analizatora, kao elektronskog instrumenta za detektovanje kvaliteta procesa obrazovanja u pravo vreme, uzimajući u obzir samo pojedine podatke kao što su prisustvo i ocene sa pojedinih ispita i notacija u visokim školama i na univerzitetima, su takodje predstavljene.*

Ključne reči: *bolonjski proces, diplomske studije, masters studije, metod virtualnog testiranja.*

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1. ROMANIAN HIGH SCHOOL EVOLUTION IN THE BOLOGNA PROCESS CONTEXT

Bologna process is a compatibility process of higher education systems in European countries. The Bologna process started in 1988, to celebrate the 900th anniversary of the University of Bologna. It was adopted as a political instrument by some EU Nation States in 1998 when there was a considerable concern over the economically unsustainable, grossly inefficient higher education systems in Europe. Historical actions in Bologna process is given in the table 1 [6]. The Bologna process of three cycles of Higher Education has received widespread approval across 48 nation states now (figure 1) [6].

Bologna Declaration (1999), signed by Ministers of Education in European countries, among which Romania foresees the creation of European Higher Education Area until 2010. Bologna Declaration is supported and promoted by the European Universities Association, the other Continental or Regional Associations of Universities in Europe. To ensure cooperation and harmonization of University studies conducted differently.

Table 1. Historical actions in Bologna process

Year	Title	Description
1987	Erasmus Programme	Established education programme from European Community
1988	Magna Charta Universitatum	Which originated from the University of Bologna to celebrate the 900th anniversary of that university, the oldest in Europe [14]. The charter simply called for an open, transparent, European HE system.
1995	Socrates Programme	Established education programme by European Community
1998	Sorbonne Declaration	This covered the harmonisation of European Higher Education, and was signed by France, Italy, Germany and the UK [9].
1999	Bologna Declaration	Most people think this was the start of the process because at that time the Declaration was signed by 29 nation states [11, 12]. Declaration on the European space for higher education.
2001	Prague Summit	This reaffirmed Bologna, and the Commission 'appreciated' role of the European Universities Association, which is the association of Rectors of European Universities (in the UK the equivalent body are the Universities UK, known as UUK) [15]. Towards the European Higher Education Area.
2003	Berlin Summit	This included the role of quality assurance in the Bologna process. It officially adopted the two-cycle degree process, and included the recognition of degrees and periods of study as defined by the European Credit Transfer System (ECTS) [8]. Realising the European Higher Education Area".
2005	Bergen Summit	This reaffirmed Berlin and added a third cycle of degrees which are exclusively PhDs. It did not embrace EngDs etc, known as the 'professional doctorates'. In Europe there are no equivalents of the UK's 'professional doctorates', and their place in the Bologna process is still undecided. Bergen also included the notion of the 'Integration of the European Higher Education Area and the European Research Area', and placed the Bologna Process as the 'instrument to achieve the integration of the EHEA and the ERA' [8, 12]. The European Higher Education Area – Achieving the Goals.

2005	Glasgow Declaration	This was largely concerned with 'refocusing the Bologna process midway to 2010'. Its banner headline was 'Strong universities for a stronger Europe', based on 'the knowledge society through higher education and research'. The manipulation of the Bologna process was thus to enhance research and innovation within Europe [13].
2007	London Summit	The UK held the presidency, Communiqué contained the statement by Bill Rammell (Minister for Higher Education) : „engage with Bologna- follow Imperial's lead” [10]. Towards the European Higher Education Area: responding to challenges in a globalised world.
2009	Final Bologna conference	The "final" Bologna conference will be hosted by the BENELUX states [7].
2009	Leuven	Conference of European Ministers Responsible for Higher Education.

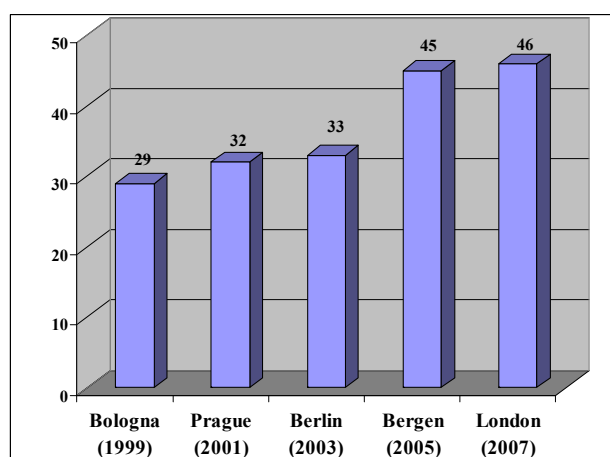


Figure 1. Number of countries in the Bologna Process

European countries have, by including the recognition of diplomas and qualifications, established some general goals whose common benchmarks are:

- Quality Assurance;
- Adopted scheme based on two cycles;
- Promoting student mobility, academic and administrative staff;
- Implementing a credit system;
- Recognition of diplomas: adopting a system of readable and comparable degrees;
- Promoting the European dimension in education higher.

EU and associated countries, noting that European higher education is much less competitive in relation to the North American, are engaged in radical changes following the objectives of the Bologna Declaration, adopted in 1999, including Romania. Academy in the UK is currently debating on "White Paper" the Government proposed in 2003 and entitled "The future of higher education", and Austria, Denmark, Netherlands and Spain have adopted in 2001 or 2002 the laws that advance changes in management systems and functioning of the universities.

The figure 2 shows the development of the students' number enrolled in higher education in Romania showing that their number is constantly increasing, indicating an upward trend of

the need for professionalism. If in the 90's their number was about two hundred thousand, in 2009 their number reached almost one million.

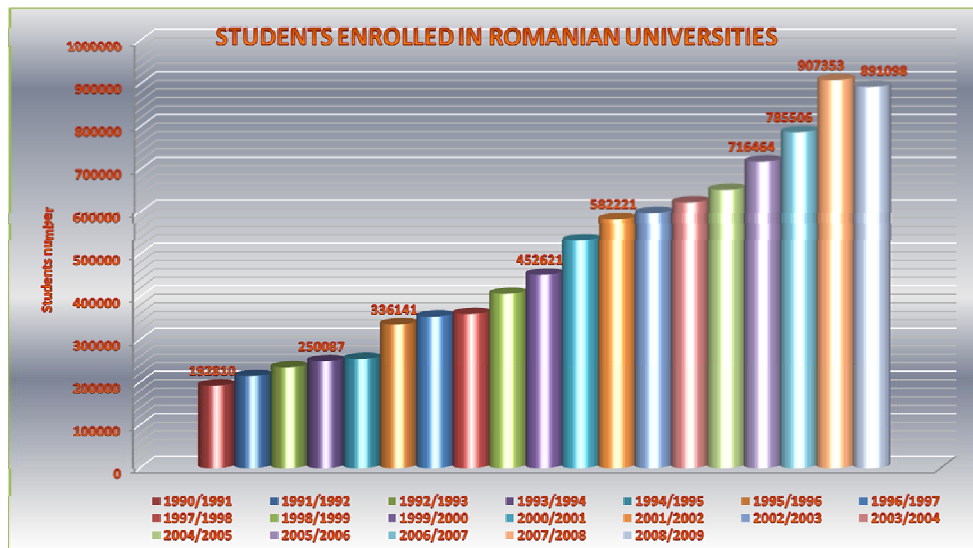
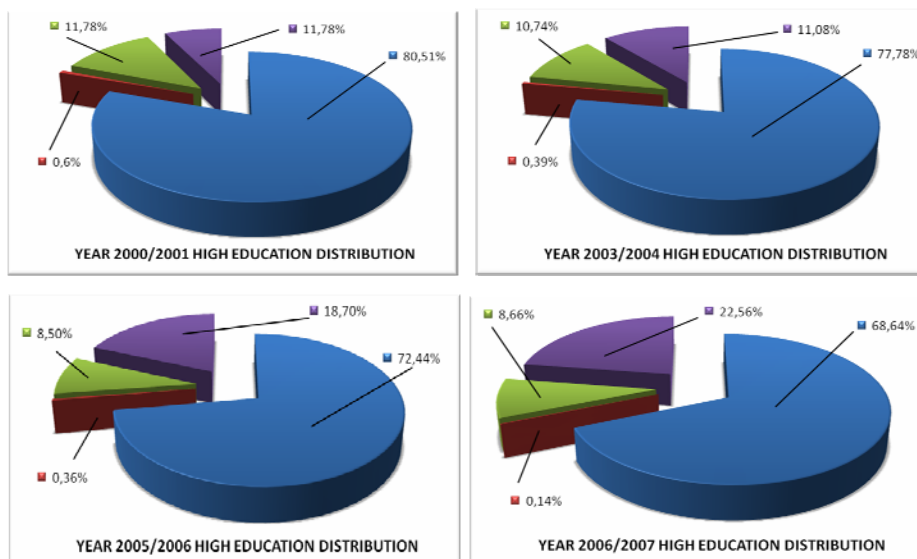


Figure 2. Evolutions of the high school Romanian education

Figure 3 displays distribution of the high school education before and after implementing Bologna's recommendations, showing that the number of students at the tax (learning at distance) system has increased significantly in recent years.



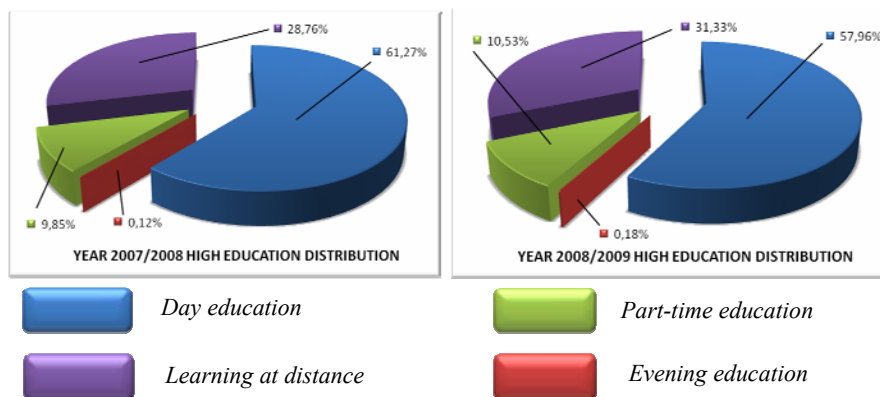


Figure 3. Distributions of the high school education before and after implementing Bologna's recommendations

2. HIGH SCHOOL EVOLUTIONS OF THE UNIVERSITY OF PETROSANI

By the Ministry of Education decree Nr.4894/1991, Institute of Mining of Petrosani's structure of two faculties (Faculty of School of Mines and Mining Machinery and Electromechanical Plant) and a college (Technical and Administrative College of Petrosani - founded in 1990) is called the Technical University of Petrosani.

Since 1995, H.G. no. 568/1995 Technical University of Petrosani referred to as University of Petrosani is having a structure of three faculties: Faculty of Mining, Faculty of Machinery and Electromechanical Installations, Faculty of Science and Technical Administration University College. Since 2003, through HGnr.693/2003 published in Official Gazette of Romania, Part I no. 466, the Faculty of Machinery and Electromechanical Installations name was changed into Faculty of Mechanical and Electrical Engineering.

Since the 2005-2006 academic year, the law nr.288/2004 regarding the university's studies organization has been applied. And also the Romanian Government Decision nr.88/2005 on the university's studies organization and Bachelor Education and Research Ministerial Order no. 3235/2005 regarding the organization of Bachelor cycle studies. In this sense, a new curricula for Bachelor studies organized in three cycles came into force:

- Cycle I - Bachelor's degree with 3-4 years duration;
- Cycle II - University of Masters studies lasting 1.5-2 years;
- Third cycle - Doctoral studies lasting 3 years.

Table 2. Dynamic entries from the 2003-2004 academic year

Academic Year	Number of seats / year			No. admission candidates
	Toll Free	Fee	Total	
2003-2004	710	870	1.580	1.295
2004-2005	710	1.130	1.740	1.435
2005-2006	710	1.500	2.210	1.620
2006-2007	725	1.900	2.625	1.730
2007-2008	725	1.900	2.625	1.850
2008-2009	982	2.856	3.838	2.272
2009-2010	982	2.856	3.838	2.334

In figure 4 is presented the total number of students from the University of Petrosani.

The strategic plan was developed taking into account the mission of the university, the situation identified in the faculty and the university as a whole, diversity of educational, human and material resources available and the requirements for the next step, as updated in the following documents:

- Bologna Declaration of Ministers of Education, June 19, 1999 and subsequent statements summit in Prague, Berlin and Bergen;
- Law on the organization of University studies (Law no. 288/2004);
- Teacher Statute Law (Law no. 128/1997);
- Law on Quality Assurance in Higher Education (Law no. 87/2006);
- ARACIS external assessment methodology (GD 1418/2006);
- Scientific development strategy in Romania;

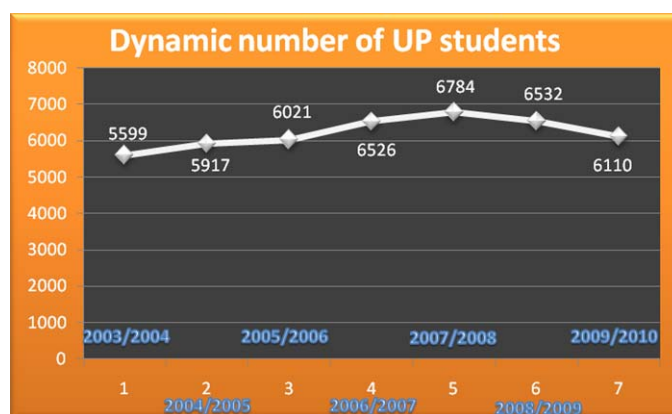


Figure 4. Dynamic number of students from academic year 2003-2004

The university's strategic plan and the annual operational plans, both of the university and the faculty component, are known by the entire university academy. Of the total number of students enrolled in the University of Petrosani (figure 4), it continues showing their evolution in recent years according to the Graduating or Master license.

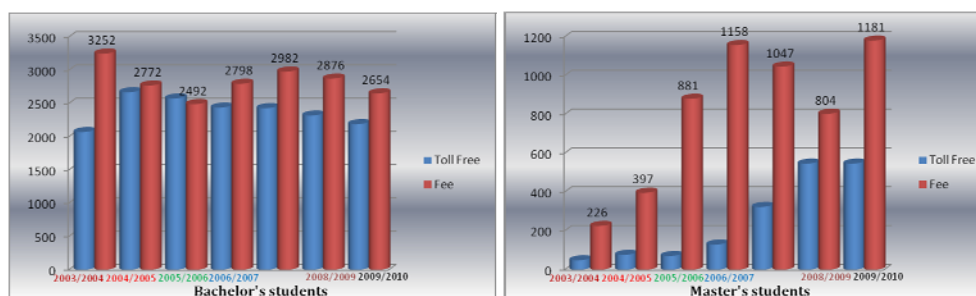


Figure 5. Dynamic number of Bachelor's and Master students from University of Petrosani

In figure 5 it is presented the dynamic number of Bachelor and Master Students from University of Petrosani and it is observed that with the entry into force of provisions of the Bologna there is a noticeable increase of the Master students' number without charge.

Adopt a structure-based study program cycles: bachelor, master and doctorate. To achieve this goal, it is necessary to develop a system of comparable and compatible qualification in each academic qualification to be described in terms of direction of study, level, knowledge, skills and profile. Be developed a classification of academic qualifications operating in the European Higher Education Area.

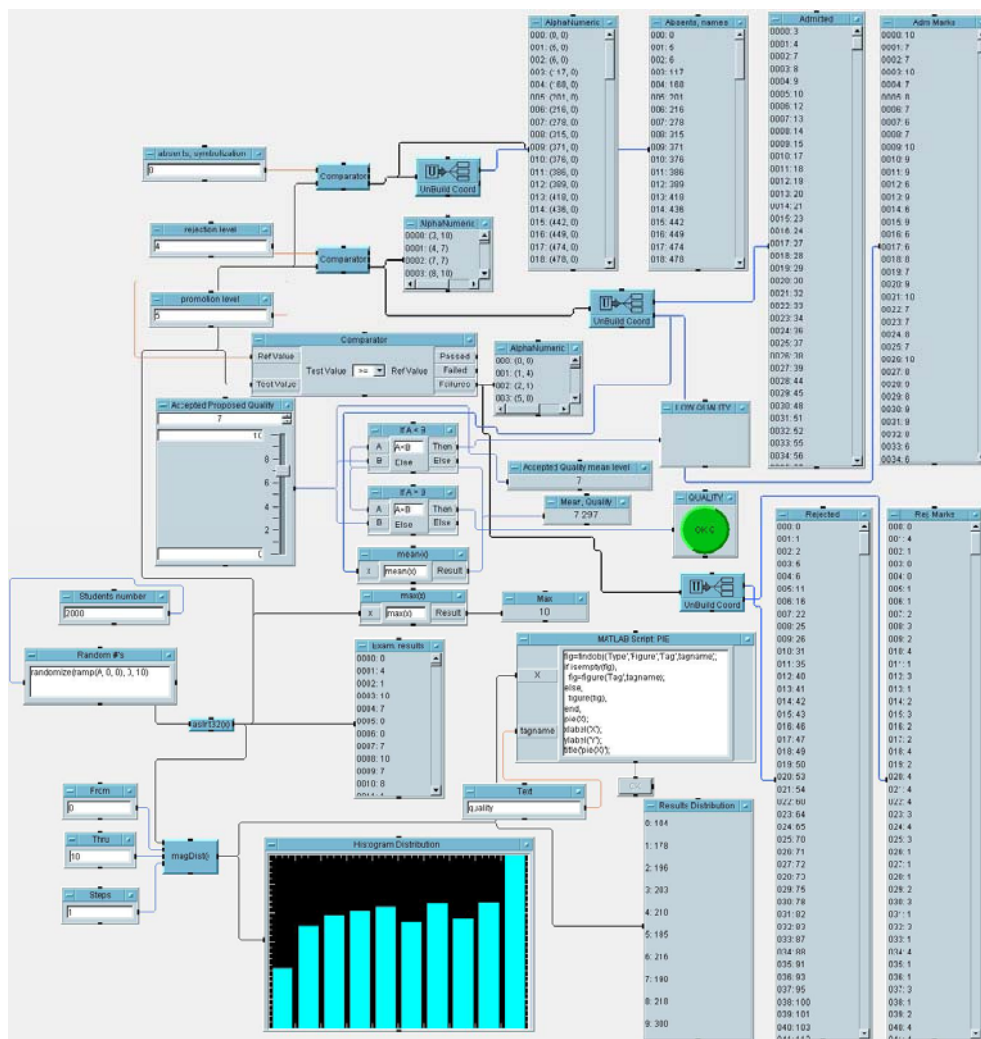


Figure 6. Graphical programming software

Following the regulations of the Bologna process, annual new programs of study are proposed for assessment, and some programs of study, if applicable, are remaining in storage. Quality management is organized and functions under the Education Law no. 84/1995, republished with subsequent amendments, the Order M.Ed.C. 3928/21 in April 2005 on quality assurance of educational services in higher education, the OU no. 75/12 July 2005 on quality assurance in education, the University Charter and the University of

Petrosani Senate's decisions which are made through specific responsibilities to ensure structure and modernization tools, analysis and internal assessment activities under the Strategic and Operational Plan University.

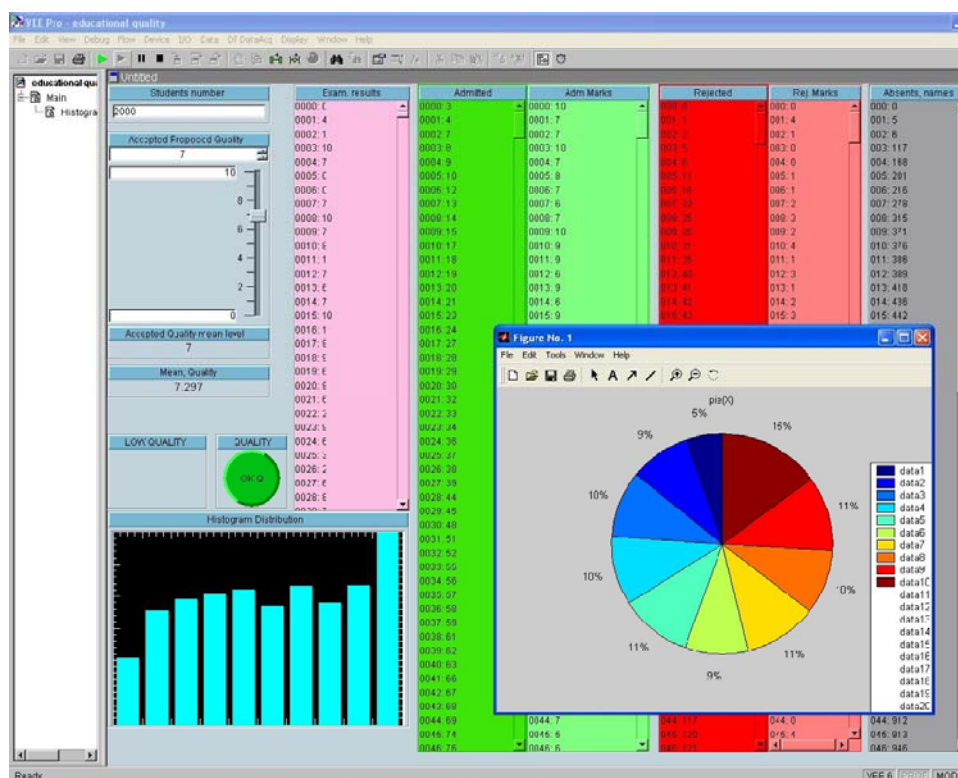


Figure 7. Graphical panel of the “educational quality instrument”

3. EDUCATIONAL COMPETITIVITY TESTING METHOD

Quality is never a luxury even in educational process. How can that be measured? We are convinced that “educational quality” can be measured and quantified. Do we have instruments for such measurements, or only the concepts exist? If IT technology can be implemented to do jobs like this, problem is solved.

So, picking up some synthetic parameters from the educational process, using adequate “transducers”, electronic interfaces and specific software, there can be obtained informational pictures about the state of the quality in an educational process developed in a school, in a college or in a university, for e.g.

The paper presents a possibility to develop and to implement a virtual analyzer, as an electronic instrument, for detecting, in real time, the quality of the educational process by taking into account only some data like the presence and examination marks from specific exams and notations in high schools, universities and so on (as shown in figure 7). The procedure can be extended easily, only by modifying processing software of the virtual instrument taking into account all, or more, information from the educational institution.

In order to achieve the objective we have been using a PC, which has a Windows operating system installed, a data acquisitions card-as an analogical and numerical interface for input-output and a developed application, using a graphics projection program, HP VEE Pro 6 & DT VPI, belonging to Data translation Company, USA. The simulation program developed, by using HP VEE Pro 6, is, in details, presented in the paper.

HP VEE Pro is a graphics programming language for the development of control software for electronic measure instruments and for data acquisitions systems (figure 6). With the help of the HP VEE software we can project graphic development applications, through the interconnection of functional objects which create a block configuration. DT VPI is the interface of data acquisition systems created by Data translation, which together with HP VEE represent the programming environment used in the implementation program for virtual equipments, instruments and apparatus.

The variety of functions of the HP VEE environment makes it a universal instrument for the development of control and measure instruments. By using HP VEE, we can achieve:

- ❑ data collection from specialized instruments and modules, the plug-in type;
- ❑ the equipment and interface control;
- ❑ data display using different types of graphic, alpha numeric displays, etc;
- ❑ load and use of the ActiveX commands, to add functionality to the HP VEE environment;
- ❑ save the programs using different formats: binary, ASCII, tables, etc;
- ❑ data processing;
- ❑ the calculus, analysis and simulation of data;
- ❑ the program loops usage;
- ❑ the adjustment and control in adjustment processes, in order to simulate, measure and calculate the output variables;
- ❑ Creating structure programs and user interfaces, etc.

By developing the principle of virtual systems in educational systems, we are opening new opportunities limited by the imagination of the application architect, in order to realize intelligent instruments capable to simulate and to analyze data concerning the quality of a complex process like training and education.

The above proposed method can be fitted to direct measure data and to process it, in real time, for complex decisions of the educational interested staff.

4. CONCLUSIONS

In accordance with commitments made by signing the Bologna Declaration and the declaration of Berlin, Romania will act for the following objectives: Organization of studies in three cycles according to the scheme promoted by the Bologna process and a closer correlation of the educational system in Romania with European education;

According to the real values presented in the paper, there are described some possibilities to simulate representative data from examination process and to evaluate results.

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