

## Web Environment for Representation, Tuition and Administering a (Magisterial) Curriculum

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**Abstract:** *The paper presents an elaboration of an Internet-based environment and tools for remote learning with holding and administering of modules and courses from a magisterial curriculum.*

*The system provides organisation of the access and a way of presenting teaching with inherent for the educational process interactive simulations in modules of the remote course. Problems are discussed for elaborating tools for monitoring the results of the trained persons and the way of perception of the information, the organisation of the links with the lecturers (forums, chats), the realisation of conditions (final tests, scores) to finish the course and also possibilities to edit and enrich the educational material.*

**Keywords:** *Information technologies & education.*

### 1. Reason for choice of a technology

Any academic community (students, lecturers, etc.) has a field of common interests and a necessity for exchange of substantial information inside this environment. The modern technologies are an attractive basis for a scientific knowledge not only with their huge possibilities for searching and penetration in the subject of the scientific field, but also with their style of open communication in the process of information acquisition. The multimedia technologies introduce the necessary interactivity, sensitivity and adequacy of the communication in the world of information streams.

When the knowledge is acquired by reading only, the efficiency is low, but when more perceptive sensors are engaged (listening, writing, communication during the teaching process), the efficiency is higher. When the environment itself has the possibility to generate common perception and if possible to control this process and to react

interactively, then the learning becomes embroiling and immersive. This explains why these environments are so attractive, why they become basic means to obtain and exchange information between young people and why they are natural environment to obtain knowledge.

The information systems based on communication technologies have the big advantage of an unified interface in this environment. This is the way to solve problems of compatibility, resolution, cyrillization, etc. The HTML language describes and visualizes the objects of different operation systems equally well. Many practical solutions of problems concerning visual communication in a single site have been established: the approaches to output the information, the navigation and the behaviour of the interactive elements were in fact organised.

Every teaching activity is sufficiently organised into teaching units and material. The knowledge is gathered, arranged and organised in textbooks, guides, etc. The curriculum is accepted as a methodical unit to organise the teaching process in a given discipline. It consists of subjects for teaching which are realised by lectures, seminars, practice, etc.

In this sense the necessary formalization of a teaching process becomes possible so that it can be described in a structure as a database. This serves as a ground to realise the methodical part of a curriculum by an administered database in the area of academic interest – in Intranet or Internet environment of the concrete educational institution. Lecturers and students present and find the information necessary for their communication by the common curriculum.

The curriculum is aimed mainly at the inner students of the educational institution because the curriculum is formed, based and uses the inner resources and the tuition logic. It is appropriate to be realised in an internal information environment, Intranet. When the knowledge in a curriculum has the possibility to be presented to a wider audience and when their significance for this is estimated, the tuition environment easily changes in Internet with its world-wide audience. This is accompanied by obligatory actions to ensure the confidentiality and the security of the transactions and the payments for its usage.

The principal difference between Intranet and Internet is expressed in the way of interaction with the environment. While the information in Internet is aimed at mass communication, the information in Intranet is more conservative and structured because it concerns an inner ring of users with formalized relations between them. Technically there is no difference in the protocols and in the realisation, except for the fact that a whole team must take care of Intranet and that this team cares much more about the contextual part of the information.

**Scope of the system:** The system provides organisation of the access, a way of presenting the educational material for perception in an environment of computer teaching with inherent for the educational process interactive simulations in the modules of the remote course, monitoring the results of the trained persons and the way of information perception, organisation of the links with the lecturers (forums, chats), realisation of conditions (final tests, scores) to finish the course and also possibilities to edit and enrich the educational material.

The realisation of a curriculum in a Web environment (Internet /Intranet) must inform the users about the ways of teaching, the lecturers, the students and the conditions for successful graduation. Complete information about the courses, their contents, duration, ways of teaching and evaluation, the conditions of graduating the different

degrees must be accessible. On the other hand, this information must be presented in accordance with the requirements for the corresponding educational institution and with the contemporary methods of describing similar curricula. These data include information about the curriculum manager responsible for its organisation, about the lecturers to communicate with according to the teaching tasks, what problems, theses and tests for self-evaluation and graduating to the next educational degree must be held, about what is required for the practical exams, etc. Every educational institution has its formalized documentation – a template to propose, teach, present and account a curriculum for the administration.

The curriculum has its meaning in the educational system with its goals and tasks, the offered competence, knowledge qualities and educational degrees to enter and to exit from it. Every actual curriculum has its clearly defined place in the organisation space of the education.

These formal elements about the existence and the contents of the curriculum are described and organised in a database. A server technology offers on its turn the direct possibility for communication between the users-clients and it thus makes it a shareware solving the problem of missing information about the curricula and their contents. The Web interface makes possible the unification with this information in a common accepted language. Generally speaking, the database gives possibility for dynamic control of the content which is systematically presented. The online access to the database allows the realisation of the information already entered into structures profiled according to the type of the authorised user.

In this way the curriculum manager can edit the teaching subjects, the information about the lecturers, etc. The lecturers can alter the information about their courses – the type, the sequence, the way of estimation, etc., but they cannot influence the obtained marks at the tests presented by them. The students are just users but their answers to the questions and the chat-sessions introduce their reaction as a feedback information.

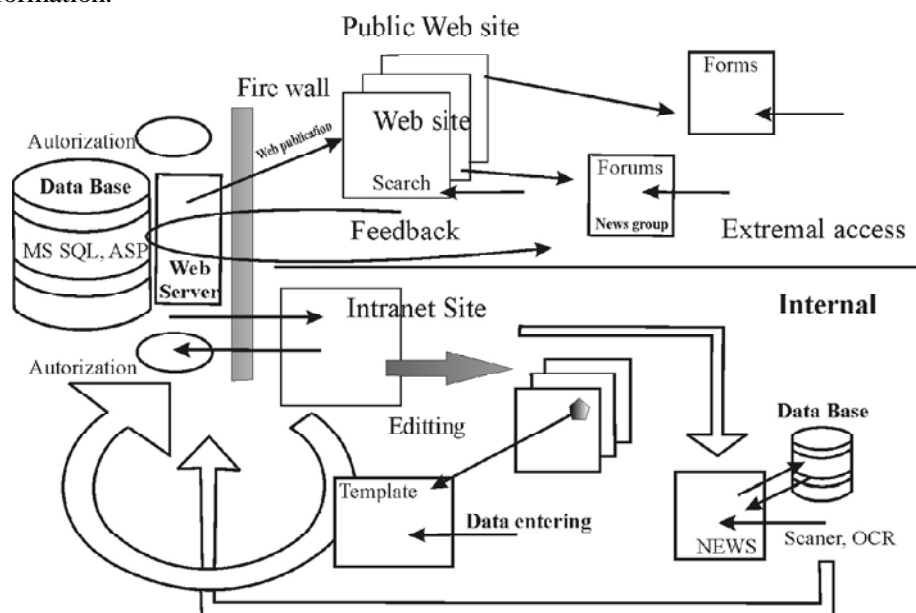


Fig. 1

## 2. How to realise the teaching process

The environment becomes tutorial when the scholar material for the courses is added to it.

The specifics of the computer education is also expressed in the amount of the information presented. The computer screen limits the perception and if we account this, the screen must output no more than several images illustrated by a picture, a simulation, image of the subject explained. In the cognitive sense of the knowledge a thesis must be postulated, developed and explained; the solution must be illustrated, the result must be analyzed, the knowledge must be practically tested and the areas of implementation must be cited. The concept perceived is organised and converted to knowledge in the experience of practical solution of the task on which this knowledge is applied. This simple scheme used in the system for remote computer-aided teaching illustrates the necessary elements of performing a computer lesson. It is significantly smaller than one lecture, but it is clear in the practical sense of its separation.

The scientific part of the system requires a more profound understanding of the computer way of teaching and perception. The lecture material must be fractionated in significant theses and appropriately illustrated. The lessons must be topically structured so as to leave also places for estimates by tests – passes for continuations forward.

At the beginning of a “lesson”, the student must be conscious of his/hers own knowledge, the concepts and the terms that he/she must gain, the subject of the material, the goals, the tasks and the destination he/she will reach if he/she accepts it. At the end of the lesson the implementation of the accepted knowledge is illustrated with an example. The self-evaluation test adds the knowledge in the arsenal of problem-solving skills connected with this knowledge.

Once made in this way, the tuition contents attract with their visual communicativeness, with their organisation and with the clarity of the information. At every instant the student knows what he/she must do, what knowledge he/she needs, what is necessary for the exam, how he/she will pass the exam and what the graduation degree is.

If there is a suitable approach to realise courses in Web environment, the education process may become much more variable and purposeful. The computer-aided scholar knowledge has its specifics which is decisive for the teaching role of the environment.

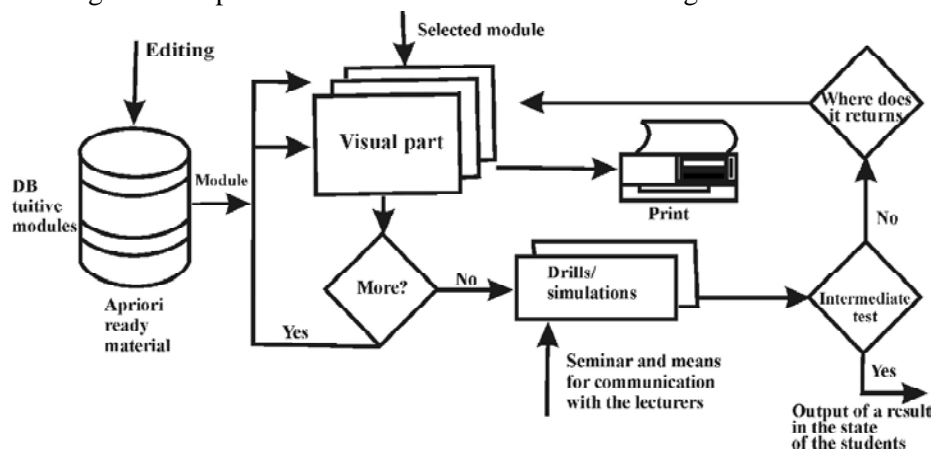


Fig. 2

For example, the elimination of the direct role of the lecturer must be compensated by efforts in the visual part of the presentation of the scholar material: there must be more images, simulations, multimedia, self-evaluation problems, etc. The lecturer becomes a teacher, a tutor when he just assists the education process in the sessions of simultaneous connection with his/her students. Then they all gather and socialize in the process of clarification of the teaching material.

Of course the role of the lecturer is performed in distant forums, at which the problems, the theses, the decisions and the difficulties in the solution process are discussed. The lecturer may use the computer to visualize his/her thesis and to teach free from any playback, directly or on an online video.

There are two common accompanying systems which must be elaborated beforehand and which are closely connected with this way of teaching. The Web environment is fit for numerous cross-references and links with concepts, knowledge, teaching resources and tools outside a concrete scheme and also inside it. A concept or definition may be repeated at many places and it may possess hyperlinks – cross-references to its definition. If these hyperlinks – cross-references are realised in an unorganised manner, there is a danger to tear the tuition line on account of easily accessible links. This explains the necessity to introduce a “vocabulary of concepts” as an inner subsystem.

The “vocabulary concepts” is a brief form to organise the accepted knowledge. The vocabulary may consist of concepts common for the whole curriculum or of concepts only for the present teaching course. These concepts and their contents are administered by an independent database and they are introduced simultaneously with the teaching material. When they are met in the presentation, there is a cross-reference to the vocabulary. A reminding of the necessary concepts is located at the beginning of every lesson.

Another system accompanying the teaching process is the one for estimation and monitoring the state of the students.

The development of a curriculum follows a program logic of the courses succession: we begin with algebra, then we have mathematics, analysis, solution of complex equations, etc.

The development of a teaching course follows a necessary succession of knowledge after knowledge; certainly, there is also a necessity to acquire the former

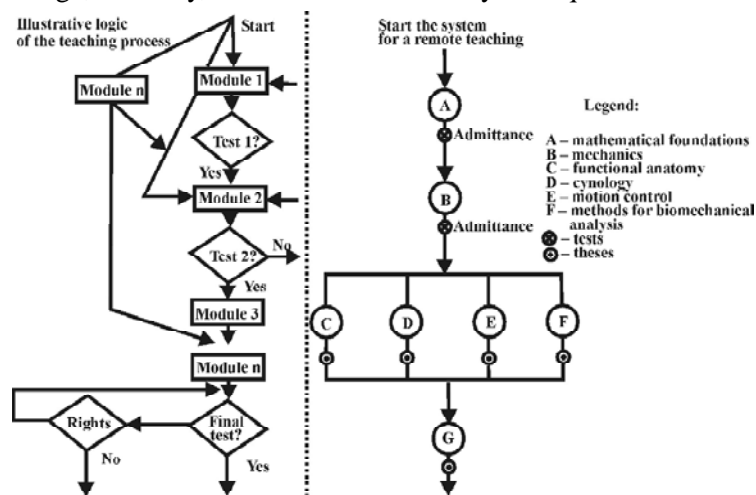


Fig. 3

knowledge prior to the acquisition of the knowledge following after it. This formalization allows to organise the navigation and the conditions to move inside a course and also inside the curriculum as a whole. The key places for transitions are the moments of solving tests for the next degrees/levels. The process of monitoring the state of students becomes more sophisticated because the development of a single program is not linear.

Monitoring the status of students is a more precise system. It consists of an independent basis for the activity and the success of the students. In fact every student participates in solving problems for self-preparation which are rated; the student passes tasks for admittance – tests or a proof of a thesis. The admittance to a new group of lessons and to new teaching topics is an act of evaluation of the knowledge, perceived from the logical sequence of lessons forming the thematic area. In the test for admittance the trained person accumulates a certain score which must exceed the threshold so that the student can continue with the first lesson in the next thematic area. In the opposite case the student has his/her second chance after which only the lecturer can confirm passing to the next level. The scores from the tests are kept; they may be used to form the final mark. The student is assessed also in chat-forums in general discussions in the Web communication space. The course finishes with the last test. The score from the examination test makes the exam mark possible.

The final mark is determined from the tests for admittance and from the final exam. The paper topic is set by the lecturer.

The curriculum manager forms a commission for the final marks from all the courses and from the tasks for successful graduation.

There are two basic groups of users with respect to the usage. The first group includes the individuals who may change the scheme. The second group consists only of these individuals who may use the information in an organised manner. All the users exert their rights after a corresponding authorization of the rights for access. The manager and the lecturers in the curriculum are included in both groups, not only with limited rights to edit the accessible matter but also with limitations only to monitor the information of their profiles.

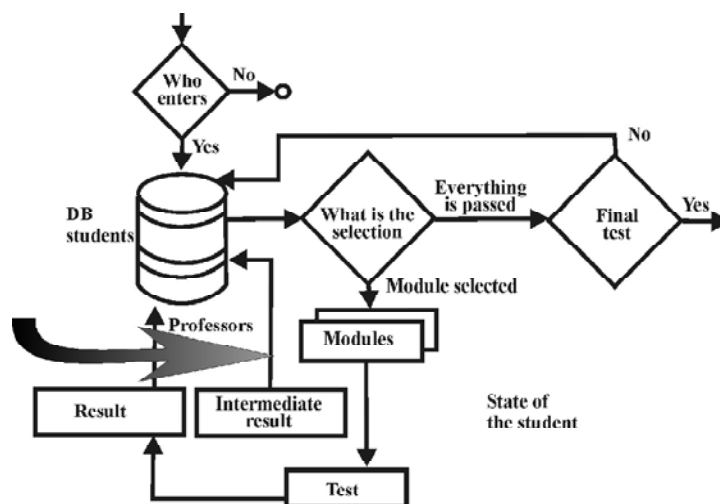


Fig. 4. The lecturer of the corresponding subject monitors the marks of his/hers students and the curriculum manager monitors the marks of all the students participating in it

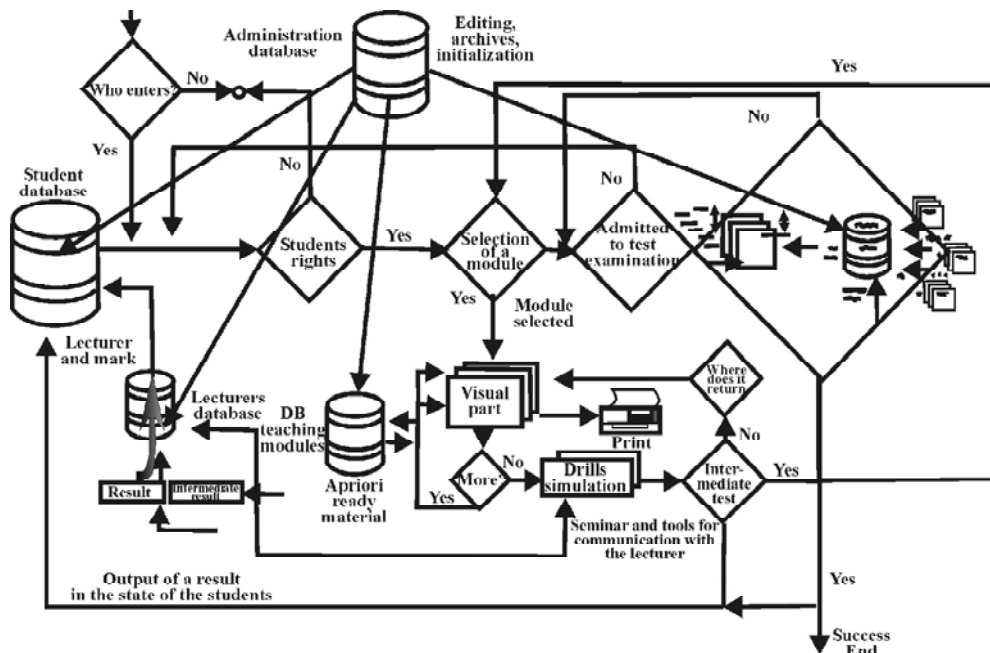


Fig. 5. Functional scheme of the data types, the control and the links between the objects with illustrative operations between them.

### 3. The first group includes

A top manager, a curriculum director and lecturers.

#### 3.1. Top manager

This user possesses a complete set of rights for the system. He must determine the necessary user names and passwords for access of the lecturers and of the curriculum director. These names and passwords are necessary for the teaching disciplines.

#### 3.2. Curriculum director

The user possesses the possibility first to enter the user name and a password. After this he/she may enter and edit the information about a curriculum or a course with their corresponding characteristics.

#### 3.3. Lecturers

A lecturer is identified by entering an user name and a password. This is followed by a visualization of the page to monitor and control the teaching contents, the tests and the theses just in the concrete teaching discipline of the lecturer. For example, the lecturer may do the following:

- enter and edit subjects;
- enter and edit plans of the lessons;
- enter and edit lesson paragraphs which comprise the lessons themselves;
- enter and edit vocabulary databases;
- enter and edit tests for a self-evaluation;
- enter and edit tests for admittance;
- enter and edit theses;
- enter and edit information about the lecturer;

- confirm the teaching process for a failed student on some of the tests for admittance or on a thesis.

#### 4. The second group includes

A curriculum director, lecturers and students.

##### 4.1. Students

After the registration, the lecturer may receive information about the program; also he/she may choose a course for teaching, an idea about the realisation of the tuitive course and a detailed information about the teaching units which are included.

When a course is selected, the first teaching unit in the course is visualized (a lesson).

Depending on the specific lesson, the student may exert the acquired knowledge in a test for self-evaluation.

The next subject in a teaching course is preceeded by a test for admittance or a thesis. If a student fails the test or the thesis, he/she must be permitted to continue the tuition by the lecturer of the discipline.

The student may participate in forums, seminars and online discussions with lecturers; he is timely tipped off about a forthcoming event by the announcement system.

##### 4.2. Lecturers

A lecturer is identified by entering an user name and a password followed by a visualization of a page to:

- review the teaching contents, tests and theses only in the given curriculum;
- review the marks of the students (in his/her course) – the lecturer may participate in online discussions with students (chats) and also in forums and seminars.

##### 4.3. Curriculum Director

Once having entered the user name and the password, the user may view the state of the students (marks in the teaching process, the last lesson included) and the characteristics of the courses and programs.

#### 5. The Internet Scenario – representation environment, teaching and administering the curriculum

The Internet environment itself is a sequence of related Access-type databases with access and visualization by SQL requests and an ASP technology with a wide implementation of Vbscript. The integration environment is Macromedia Ultradev, which guarantees a high degree of code optimization and a compatibility on all levels of integration and visualization.

Generally speaking the functional modules cover the basic three aspects of the teaching activity: representation of the tuitive material, monitoring the state of the students, and also general management and representation of the information. Such approach allows to profile the typical users in such systems. The retrieval of an user profile is a prerequisite to structure the information which shall realise its goal-compatible output to the client.

The database is logically divided into three modules: administrative module; tutorial module; student module.



5.1. The **administrative** module contains information about:

- curricula;
- teaching courses in every curriculum;
- teachers for every teaching course;
- user access and levels of access;
- event-driven auxiliary and warning messages.

5.2. The **tutorial** module contains information about:

- subjects of the lessons;
- plans of the lessons;
- lessons themselves;
- exam theses for admittance;
- exam tests for admittance;
- self-evaluation tests;
- vocabulary of basic concepts.

5.3. The **student module** contains information about:

- momentary state of the students in the system, the last lesson included;
- chosen examination theses;
- chosen examination tests;
- chosen self-evaluation tests.

Some of the relations in the database are as follows:

The tutorial module is illustrated in Fig. 6.

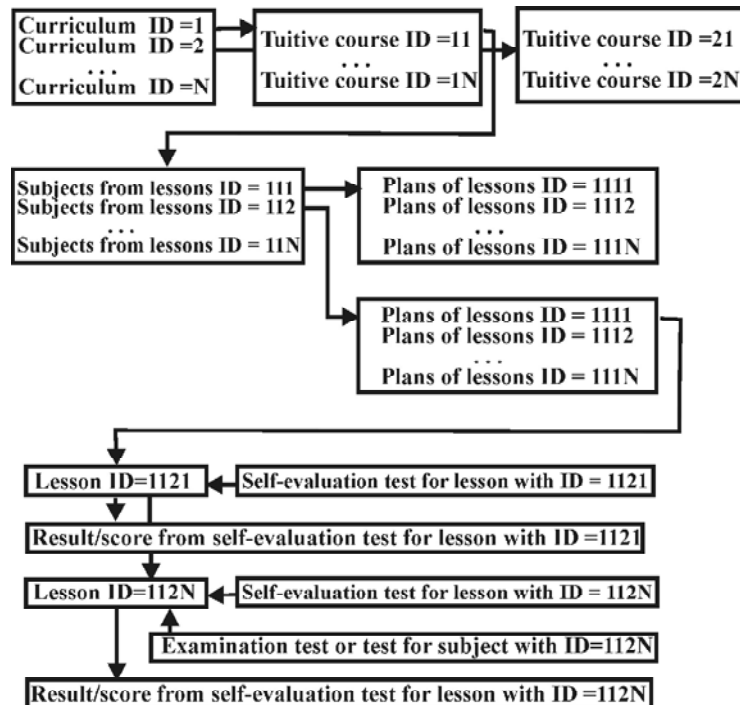


Fig. 6

The administrative module is illustrated in Fig. 7.

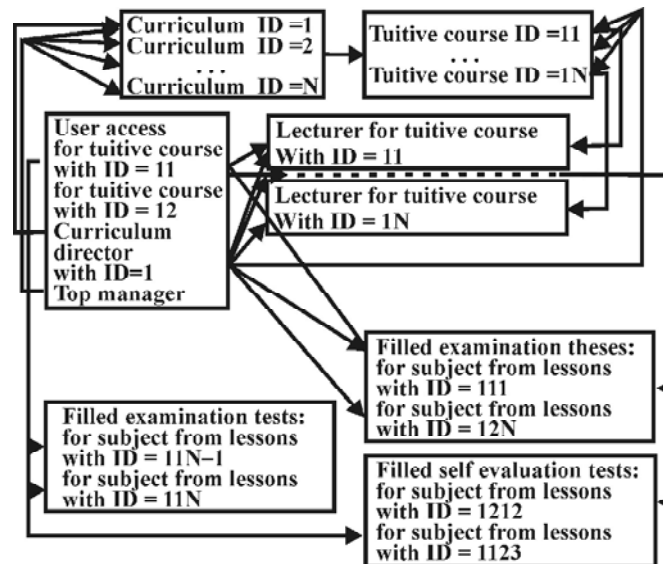


Fig. 7

In general the modules represent the functionality of the environment for the profiled user. For example, one module reacts to an editing session of the lecturer, another when the lecturer changes the teaching information, a third reacts to a wrong password. All modules responsible for the profile of the lecturer form the functional tasks of the program module. This module serves the lecturer in the system. Thus, the idea to profile the users is realised on a logical level.

At this stage the behavioral logic does not possess a detailed structure and the client may choose only between his necessary tasks. For example, the predefined behavior of the student is: to be familiar with textual and graphical materials, to use simulations and vocabulary in the discipline, to evaluate himself/herself, to go to the next lesson, to deplete the subject of the lessons, to reach the test for admittance for the next level and to pass it.

The tutorial material is schematized to the level of textual and graphical or animated illustrations. The goal is to keep some definite line of behavior of the taught students. Every lesson has an introduction and a plan with explanations about the tasks and the goals in it and also with examples of the results achieved with this knowledge. This scheme of perception reflects the structure of forming the knowledge, i.e. the system is designed with some systematic behavior which must lead to the maximal perception.

I. The administrative module for input and editing the information about the curricula and teaching courses is designed to input and edit the information in the curricula and the teaching courses.

Structurally the module is divided into two parts:

- Programs and courses for:
  - *input* of information about the sequence number, name, necessity, duration, etc.;

- *editing* the information.
- Courses are for:
  - navigation for the choice of the program the teaching course is related to, and *input* of information;
  - navigation for the choice of the program the teaching course is related to, and *editing* of the information.

II. The administrative module for input and editing the information about the lecturers – Rights for access are possessed by the curriculum director, the top manager of the whole system and the lecturers (with limited rights for access – they may not input or change their user's name or password).

III. The administrative module for input and editing the information about the contents of the tuitive disciplines – rights for access are possessed by the curriculum director, the top manager of the whole system and the lecturers (with limited rights for access – only for their own teaching disciplines). Structurally the module is divided into three parts.

- Subjects of the lessons are:
  - navigation for choices inside the curriculum and the teaching courses and *input* of information about the topic /sequence number, plan, type of admittance (test or thesis), and necessary percentage of correct answers if the admittance is by a test/;
  - navigation for choices of curricula and teaching courses and *editing* the information.

- Plans of the lessons are:
  - navigation for choices of curricula, teaching courses and subjects and *input* of the information about the plan and the sequence number of the lesson, goals and tasks, necessary knowledge and concepts, concepts with links to the vocabulary of the basic concepts /there is a reference to the vocabulary/, expected results, test for self-evaluation, an example from the practice, and possibility to input an additional text that can be visualized as some system message in the page with the given lesson;
  - navigation for choices of curricula, teaching courses and subjects and *editing* the information.

- Contents of the lessons:
  - navigation for choices of curricula, teaching courses, subjects and lessons and *input* of the information for the given paragraph /an item, text of the paragraph, illustrative material (image or animation), name and extension of the file with the illustrative material/;
  - navigation for choices of curricula, teaching courses, subjects and lessons and *editing* the information.

IV. Administrative module for input and editing the vocabulary of the basic concepts is designed to input and edit the vocabulary of the basic concepts. Structurally, the module is divided into two parts.

- Input of concepts and their definitions; when written, they get unique identification numbers;
- Editing the basic concepts.

V. Administrative module for input and editing the information about the tests is structurally divided into the two parts.

- Self-evaluation tests:
  - navigation for choices of curricula, teaching courses, subjects and lessons and *input* of information about every question on the tests /given question and its sequence number, possible answers, correct answers, scores for every correct answer, visualization of the possible answers (radio buttons or notes), names and extensions of the image file if there is an illustration of the question/
  - navigation for choices of curricula, teaching courses, subjects and lessons and *editing* the information
- Tests for admittance:
  - navigation for choices of curricula, teaching courses, subjects and lessons and *input* of the information about every question in the test /given question and its sequence number, possible answers, correct answers, scores for every correct answer, visualization of the possible answers (radio buttons or notes), names and extensions of the image file if there is an illustration of the question/
  - navigation for choices of curricula, teaching courses, subjects and lessons and *editing* the information

VI. The administrative module for input and editing the information about the theses.

VII. The administrative module for input and editing some foreseeable mistakes and auxiliary messages about the operation of the system is structurally divided into two parts:

- Input of a foreseeable event and its possible solution or the reason for it; when written it receives an unique identification number;
- Editing of input events and an auxiliary information the information in this module is common for all curricula and tuitive disciplines.

The information in this module is shared by all curricula and teaching disciplines.

VIII. The administrative module for reviewing and editing the state of the students – There is navigation for choices of the tuitive disciplines. Every lecturer may review the results only of the students in his courses.

The output includes data about the students and links for a detailed review, evaluations and editing of the results from the tests and the theses. There is also a possibility for searching a concrete student according to a defined criterion (faculty numbers, personal names or family names).

IX. The user module for monitoring the state of the students – passed or failed the tests and evaluated or unmarked theses, allowing the student to send a request by E-mail to the lecturer for admittance to the next tuitive level on condition that the achieved results in the examination are insufficient.

X. The user module for warnings about attempts of students to access the teaching material on condition that they do not possess the necessary rights, with explanations about the possible reasons for the rejected access and recommendations.

XI. The user module to receive a forgotten password by E-mail (started if the system authorization is impossible).

XII. Module for registration of the students in the system.

## 6. Domains of application

The system allows the multiple and multifunctional usage in a heterogeneous tuitive environment. It is designed to generally satisfy the contemporary methods of description, structuring and development of the tuitive process. It is possible to reflect the structure and the contents of every curriculum based on logical sequence of tuitive subjects consisting of textual and visual teaching material.

The input of its descriptive part follows a template – a standard model of the structure which describes such programs: description, goal, competence, lecture staff, conditions for graduation, etc.; such information is typical for any contemporary program. The courses are represented by their subject field, description, conspect and ways of lecturing (syllabuses), ways of evaluation, graduations, accreditations, etc. The organisation also includes information about the lecturers of the courses concerning basic data about their scientific fields, devices for communication, scientific references, etc.

The ease of editing the tutorial contents allows its renovation to be very fast and easy, the fast creation of new courses included. On its turn, the Internet environment allows the wide distribution and accessibility independently on the operating system and the computer configuration of the user. It is possible in this way to quickly organise and hold refreshing courses and specialisations in various narrow directions.

It is possible to update instantaneously the information, the tests, the theses and the communication system, and the whole system will be appropriate for more than one curriculum.

The Web environment may be used for remote organised teaching and lecturing of tuitive information. The ease of the solution, the small space of program scripts, together with the standard and mobile solutions in the curriculum make it easy for applications and portable. It is applicable as an information system where the information is published in a centralised and systematic way and the tuitive activity is realised in a convenient for the lecturer place. The system registers and saves his/her activity with estimates about his/her perception of information objectively and independently of the conditions.

The system uses an approved Microsoft technology for communication with standard databases. This determines why the system is designed mainly for local networks, for Intranet and for specific inner applications. The application of the system is possible also in Internet with good managing and reliable security behind Firewall and also with conditions for a vouched security during examination tests.

The security options during authorisation may cover payments with credit and debit cards if necessary.

## 7. Conclusion

The systems for remote teaching by Web are unknown in tuitive practice mostly because of the slow invasion of Internet, the lack of discussions about the possibilities of this

medium and the great variety of educational systems in Bulgaria and all over the world.

The creation of this system solves another more specific problem – the problem not only to teach knowledge but also to upbringing the taught students in the process of the organised perception of knowledge.

The scientific stratum in the society changes constantly, and the teaching of an individual is continuous in his/her creative activity. This requires a structural approach to the knowledge representation and organisation of the ways for their perception.

The present system is developed for National Sport Academy “Vassil Levski” and designed to be used in teaching students. The system meets completely the requirements for Learning systems in British Commonwealth.

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## Web среда за представяне, обучение и администриране на (магистърска) учебна програма

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### **(Резюме)**

Разработена е Интернет-базирана среда и средства за дистанционно обучение с провеждане и администриране на модули и курсове от една магистърска програма.

Системата обслужва организацията на достъпа, начина на представяне на учебния материал за възприемане в среда на компютърно обучение с присъщите за учебния процес интерактивни симулации в модулите на дистанционния курс, следене на резултатите на обучаваните и начина на възприемане на информацията, организиране връзката с преподавателите (форуми, chat), реализиране на условия за завършване на курса (краен тест, събиране на точки), както и възможности за редактиране и обогатяване на учебния материал.

Интернет-средата представлява последователност от свързани бази данни тип Access, достъпът и актуализацията до които става чрез SQL заявки, чрез ASP технология, с широко ползване на Vbscript. Средата за интегриране е Macromedia Ultradev, която гарантира висока степен на оптимизация на кода и съвместимост на всички нива при интеграция и визуализиране.