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The Review on Computer Modeling and Computer Experiment in Pedagogical Researches in the Example of Uzbek Education System

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Abstract

In given article questions on directions of the theory and practice of computer modeling and the organization of computing experiment are considered at carrying out of pedagogical researches. Its condition for today is analyzed and the mathematical model of processes of testing is offered. In this article objects of creation methods and models of teaching material setting-up in depend on states of trainee in intellectual education systems are considered.

The computer system of Uzbek Spellchecking depends on many scientific researches which were made for other agglutinative languages. Effective algorithms that can solve this problem using small amount of resources and without a waste of time are discussed in this paper. Also here the program's graphic user interface and its full functionality have been described.

In the third part of the paper the results of analysis of Russian Federation and Kyrgyz Republic educational standards in Information Technology, Computer Sciences, Informatics, Applied Mathematics and other are considered in this paper. Required changes are bringing out that must be made for development new educational standard corresponding Bologna Process. Important specifics of educational standards of European Countries and United States are showing. New educational standard on field "Informatics and Computer Engineering" are suggested for bachelor level of Kyrgyz Republic. In the suggested standards four blocks of previous standards are saved to provide continuity with standards former generation.

1. Introduction

Now the theory of training and methods of research of educational process are basically descriptive, therefore possession of a technique of any subject remains property of separate teachers and teachers. But today, as never, sharp there is a question on transition of the theory of training from the empirical form to demonstrative, settlement, predicting.

That system of the formation gave high efficiency it is necessary to use the obtained result of management complex object. Organize the process of the education teachers use three main types of the special knowledge's: area of the teaching, methods and strategies of the education, knowledge's about trained. To him possible to add the following communication functions: teach trained, choice of the forms and features given information and decision making. [1].

There are many computer systems for spell checking and correcting mistakes for different languages, but still there was no such system for Uzbek language. In the beginning of 90-s at the Samarkand State University by group of young physicians was created system *Aspell* with large enough word base (31000). But this system wasn't expanded in Uzbekistan, because it was written for *Linux*, and in our region most of users
prefer Windows Operation System. Creators of the system used program *HunSpell* – the system for Hungarian spellchecking, in case of analogy of construction of words in Uzbek and Hungarian languages. Both of them attached to agglutinative family of languages.

Agglutinative languages – type of languages, which have specific construction. Words in such type of languages are generated using agglutination – (from Lat. - "gluing, adding") process of grammatical and word forms creation by consecutive adding (or its base) different type of grammatically monosemantic affixes and prefixes to a root of word of its base, that keeps borders of morphs constant. Agglutinative languages, for example: Uzbek, Hungarian, Turkish, Kirghiz, Kazakh, Hebrew, Finnish, Turkmen. But in 2005 Spanish programmer Jesus Rodrigez, who writes under "Dream Tangerine" nickname, had represented universal version of spell checker JMySpell, written by using Java programming language. It's opened an opportunity to use it in a great amount of operation systems.

Business globalization, creation of International Corporation's wide dissemination of a work's division has made actual a problem of a coordination of university educational programs of the all countries. Attempts of the decision of this problem have found place in documents of the «*Bologna's Process», directed on gradual convergence of national educational systems for the purpose of an uniform educational world space development.*
Major principles of the Bologna declaration include:
• Two-level higher education
• European's system of credit units
• Compatible quality of higher education
• Flexibility of training
The important role in the decision of educational systems convergence problems is the designing of higher educational standards and the corresponding curriculums to the standards. In this means it is possible two basic approaches of ensure of globalization to be distinguished:
• The first – North American is directed on design of typical models of knowledge volumes and Computing Curriculum for preparation of IT experts of a various profile. *To the same approach hold the country of South East Asia also*.
• The second – are developing by the European consortium Career Space - is intended for development of requirements to competence of university's graduates and to the corresponding educational standards that are forming by employers (*the companies working in sector of information and communication technologies*) .

In a difficult situation there was our Republic with independence acquisition. Many questions of its existence in the conditions of economic recession, including higher education problems, it is necessary to reconsider and solve independently. Thus on decision-making in an education sphere affects also, undoubtedly, traditional commitment to the Russian norms and standards, fixed by the intergovernmental pact on a mutual dissemination of diplomas on higher education. The desire to follow the Bologna declaration requires the new variant of state education standard our Republic SES HVT "Informatics and Computer Engineering" develop.

The Russian Federation state educational standards of the higher vocational training (SES HVT RF) are confirmed and operating currently allow to pass to two- level higher education. At the same time, the operating till now standards do not satisfy to the requirement *of*

compatibility of education's quality, without which mobility of training is inconceivable. The main cause of this problem are that the standards in directions HVT in the IT area are developed *independently* from each other, as a result of this they are excessively many.

According to Bologna principles should operate the fewer number of educational standards on all spectrum of higher education rather. Significant variability in each direction must be saved (as it is accepted in European higher schools where only disciplines for choice the student make one not less than 40 % from the general labor input of training). However, if to look on titles of existing disciplines in SES HVT RF and essence of topics of theirs sections, it is possible to see, that the volume of their mutual distinctions in hours or credits (test units) does not exceed often 20–30 %. It is possible to replace each such group of standards with the general SES HVT in one direction. In this general standard it is possible to cover completely all initial group SES HVT if we use disciplines of specializations and optional disciplines [1-7]:

Group of 11 directions and the majors concerning area «Computing» in the Russian Federation are listed following [1-7]:
• 230100 –Informatics and Computer Engineering
• 010400 –Information Technology
• 010300 –Mathematics. Computer Sciences
• 230200 –Information Systems
• 010503 –Software and Management of Information Systems
• 080700 –Business Informatics
• 080800 –Applied Informatics
• 010500 –The Applied Mathematics and Informatics
• 090102 –Computer Safety
• 050202 –Informatics (Pedagogical Specialties)

Group of directions and the specialties concerning area «Computing» in KR:
• 522800 Informatics and Computer Engineering
• 522802 Information Systems
• 552802.01 Information Technology
• 650003 Applied Informatics

Group of directions and specialties in area «Computing» at universities in EU countries [4-6]:
• Computer Science
• Computer Engineering
• Software Engineering
• Information Systems
• Information Technology

2. Computer modeling and computer experiment in pedagogical researches

2.1 The theory of computer modeling and computing experiment

As one of means of such transition can act, in our opinion, the theory of computer modeling and computing experiment. Analyzing scientific works on this question, it is possible to allocate some directions [3]. The first direction - gynecological in which the

computer model acts as intermediate object in the course of material knowledge, that allows to reveal communication between the quantitative and qualitative parties of the phenomena. Models of this direction express not only that general, that there is between the individual phenomena in the given area, but also that unites various areas.

The second direction is the use of computer model instead of the original. This direction allows receiving data on studied object which do not manage to be received in nature, to reveal the original nature, to carry out forecasting of development of object of studying. The third direction - modeling-information, designed taking into account likelihood character of process of training, with use of statistical data of process that allows revealing certain laws of object of studying. The fourth direction is analytical. By means of such computer model the analytical or graphic description of a certain part of process of preparation of the pupil on the basis of corresponding qualitative and quantitative characteristics is given. It is possible to carry block diagram's and the models reflecting an information transfer, its comprehension, training, inculcation of skills, the control over mastering to this direction etc.

The fifth direction is general-methodological, allowing estimating communications in training between subjects and the disciplines forming outlook of trainees. The sixth direction is psychological. These are attempts of modeling by means of information technique of the person of the trainee, behavior of student's collectives for studying of their biological, psychological, social properties and features. Such modeling should be spent taking into account adaptation of people to various external conditions and is stimulating factor and in the course of perception of new data.

Now pedagogical researches are directed on that search and application of the developed methods in one area of methodical researches to extend to another. As an example computer training which was investigated practically by each private technique can serve it, but at the same time basic features and possibilities of training with personal computer use up to the end are not opened. Undertaken separate attempts of generalizations also are not basic. From this point of view computer modeling and computing experiment are necessary for research of educational process as a whole, and also possibilities of a technique of teaching of separate disciplines. One of the vivid examples in respect of introduction of methodology of computer modeling and computing experiment in training is the subject «the Computer drawing and design». First of all it is connected with character of the studied material supposing construction of computer models and research of the phenomena by a method of computer imitating modeling. Models are taken as a principle demonstration and training programs, programs of training apparatus and numerical experiment.

Besides it on employment "traditional" forms of use of the personal computer - the computer control of knowledge, generation of individual tasks for the decision of problems, carrying out of calculations are possible also.

Besides, transition was outlined in subject teaching «the Computer drawing and design» from use of training programs on separate sections of a course to creation and practical introduction of complexes educational methodical and the software.

Therefore for teachers-experts, methodologists and developers of applied software rather important the information on that what productivity, that is adequacy of those or other elements of computer technologies of training and concrete program systems in comparison by traditional technologies is represented. Such information can be received under the scheme or on the basis of methods of mathematical modeling and computing experiment.

Thus the received information, undoubtedly, would allow to allocate the most effective and rational forms of the organization of educational process in the conditions of information of formation and to formulate recommendations about kinds and the maintenance of curriculums.

2.2 The analysis of test tasks

As an example of use of mathematical modeling we will consider process of testing of trainees by results of training the realized on the personal computer.

Let we have some set of test tasks $\{T_k\}, k = \overline{1,n}$, where *n* - the general number of tasks. For each task T_k,we will have some set of accessible variants of answers $\{A_{k,j}\}, j = \overline{1,m_k}$, where m_k - quantity of variants of the answer for task T_k. We will present set of true answers to problem *Tk* in the form of indistinct set *Rk* with function of accessory $\omega_R(A_{k,j})$ and universal set $\{A_{k,j}\}, j = \overline{1,m_k}$. Let accessory function is limited and $\omega^{k,\max} = \max_j(\omega^k(A_{k,j}))$ - height of set R_k. In a case when $\omega^k = \{0,1\}$, we will deal with the "usual" test task with two types of answers: true and incorrect.

The elementary analysis of tests begins with calculation of true answers to the concrete task [1]. Let *Sk* – the variant of answer *Ak, j* on problem *Tk,* which tested has considered true, or *Sk* =*Z* in case the tested has considered, that any variant of the answer is not correct. Having designated for *Pk* total of attempts of the answer to problem *Tk*, we can calculate two sizes:

$$x_{k,1} = \sum_{i=1}^{P_k} \begin{cases} \dfrac{\omega_i^k}{\omega_i^{k,\max}}; \omega_i^{k,\max} \neq 0; \\ 0; \omega_i^{k,\max} = 0, S_{k,i} \neq Z \\ 1; \omega_i^{k,\max} = 0, S_{k,i} = Z \end{cases} \quad (1)$$

$$x_{k,2} = \sum_{i=1}^{P_k} \begin{cases} \dfrac{\omega_i^{k,\max} - \omega_i^k}{\omega_i^{k,\max}}; \omega_i^{k,\max} \neq 0; \\ 1; \omega_i^{k,\max} = 0, S_{k,i} \neq Z \\ 0; \omega_i^{k,\max} = 0, S_{k,i} = Z \end{cases} \quad (2)$$

We name *xk, 1* - factor of the given true answers to problem T_k, x_k, *2* - factor of the given incorrect answers. In case $\omega^{k,j} = \{0,1\}$ these sizes will designate quantity truly and incorrectly given answers accordingly. For simplification of the further calculations it is normalized R_k. It is possible according to an assumption about limitation of function of accessory ω^k. We will make replacement $\tilde{\omega}^k = \dfrac{\omega^k}{\omega^{k,\max}}$, and we will not consider in (1) and (2) variant when among the offered answers there is no true. In this case calculation of factors *xk, 1* and *xk, 2* will be reduced to two simple formulas:

$$x_{k,1} = \sum_{i=1}^{P_k} \widetilde{\omega}_i^k, \tag{3}$$

$$x_{k,2} = \sum_{i=1}^{P_k} (1 - \widetilde{\omega}_i^k) \tag{4}$$

Having designated $N_k = x_{k,1} + x_{k,2}$, we can calculate two important characteristics - a measure of right answers $y_{k,1} = x_{k,1} / N_k$ and a measure of wrong answers $y_{k,2} = x_{k,2} / N_k$.

2.3 Testing model

But the analysis of concrete test tasks is not end in itself, more often us the analysis of some set of the test tasks represented as something whole interests. So, we come to test definition. We will name test *Qi* - a set of test tasks $\{T_k \mid \psi^i(T_k) = 1\}$, where $\psi^i(T_k)$ - function of an accessory of the test task to test Q^i, having a range of definition set $\{T_k\}$ and accepting two value: 1 - in case task T_k is included into test Q^i and 0 - otherwise.

Being based on the given formal scheme of representation of tests, we will draw some conclusions concerning a way of storage of the information in systems of an estimation of knowledge. Accessory function ψ*Z* can be realized in the form of the table with two fields, first of which - identifier *Qi*, and the second - identifier *Tk*. Having divided the table containing information on set of tests {*Qi*}, the table of test tasks and the table of communications (accessories) of test tasks to concrete tests, we get possibility any way to change the size of the test (quantity of test tasks entering into it), and also not increasing it is essential to use the sizes of base one test task in various tests.

Let's give an example calculation of factor of correlation Pirsons for two "parallel" tests for sample of examinees $\{X_l\}, l = \overline{1,h}$, where *h* - number tested. Let $Q^i = \{T_k \mid \psi^i(T_k) = 1\}$ and $Q^j = \{T_k \mid \psi^j(T_k) = 1\}$ - two "parallel" tests, $x_{k,1}^l$, - the size calculated under the formula (1) or (3) on concrete examinee X_l (thus $P_k \equiv 1$). Then calculation of factor of correlation will look as follows:

$$r_{ij} = \frac{SP_{ij}}{\sqrt{SS_i * SS_j}},$$

where:

$$SS_i = \sum_{l=1}^{h} \left(\left(\sum_{\forall k \mid \psi^i(T_k)=1} x_{k,1}^l \right)^2 \right) - \left(\frac{\left(\sum_{l=1}^{h} \left(\sum_{\forall k \mid \psi^i(T_k)=1} x_{k,1}^l \right) \right)^2}{h} \right),$$

$$SS_j = \sum_{l=1}^{h}\left(\left(\sum_{\forall k\left|\psi^j(T_k)=1\right.} x_{k,1}^{l}\right)^2\right) - \left(\frac{\left(\sum_{l=1}^{h}\left(\sum_{\forall k\left|\psi^j(T_k)=1\right.} x_{k,1}^{l}\right)\right)^2}{h}\right),$$

$$\mathrm{SP}_{ij} = \sum_{l=1}^{h}\left(\left(\sum_{\forall k\left|\psi^i(T_k)=1\right.} x_{k,1}^{l}\right)*\left(\sum_{\forall k\left|\psi^j(T_k)=1\right.} x_{k,1}^{l}\right)\right) - \left(\left(\sum_{l=1}^{h}\left(\sum_{\forall k\left|\psi^i(T_k)=1\right.} x_{k,1}^{l}\right)\right)*\left(\sum_{l=1}^{h}\left(\sum_{\forall k\left|\psi^j(T_k)=1\right.} x_{k,1}^{l}\right)\right)/h\right).$$

The given scheme gives more flexible system of realization of exhibiting of a total point for the test. Let $B_k^{\max}$ - a point which the examinee can receive, having chosen as the answer to task T_k such variant of answer $A_{k,s}$, that $\omega^k(A_{k,s}) = \omega^{k,\max}$. Then begins possible to count a point received at a choice of answer $A_{k,i}$ on task T_k, under the formula:

$$B_k^i = B_k^{\max} * \frac{\omega^k(A_{k,i})}{\omega^{k,\max}}$$

However this is not a unique method of calculation of a point which can be realized within the limits of the given model.

3. Shaping Scholastic Material in System of the Intellectual Education

3.1 Trend of the work electronic scholastic allowances

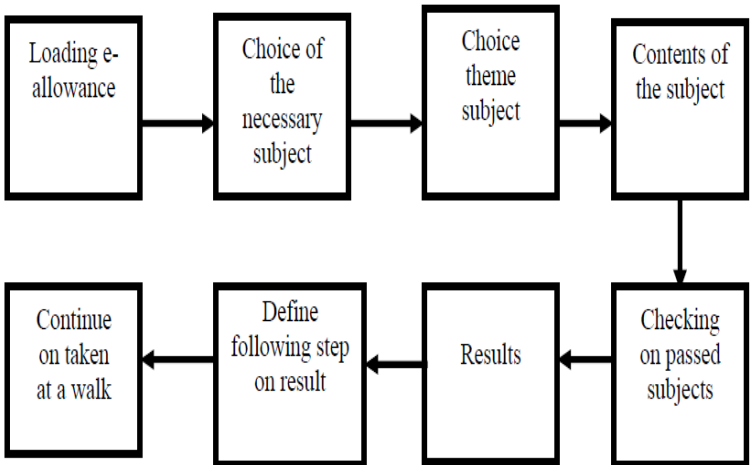

Figure 1. The Principle of the work ESA

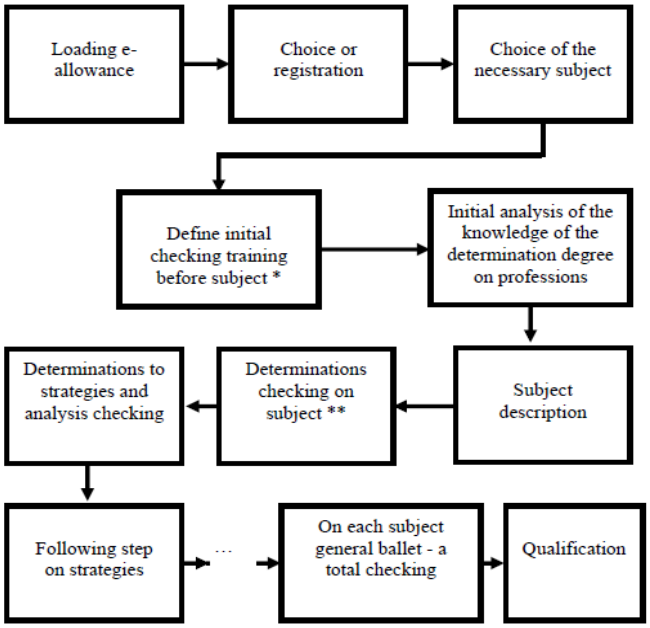

Figure 2. Recommended IESA - a principle of the work

IESA (intellectual electronic scholastic allowance) the structure database and base knowledge in base contact between itself possible to express thereby. We get acquainted with rather work. It is designed considered positions and recommended electronic scholastic allowances (ESA) get acquainted with principle of the work.

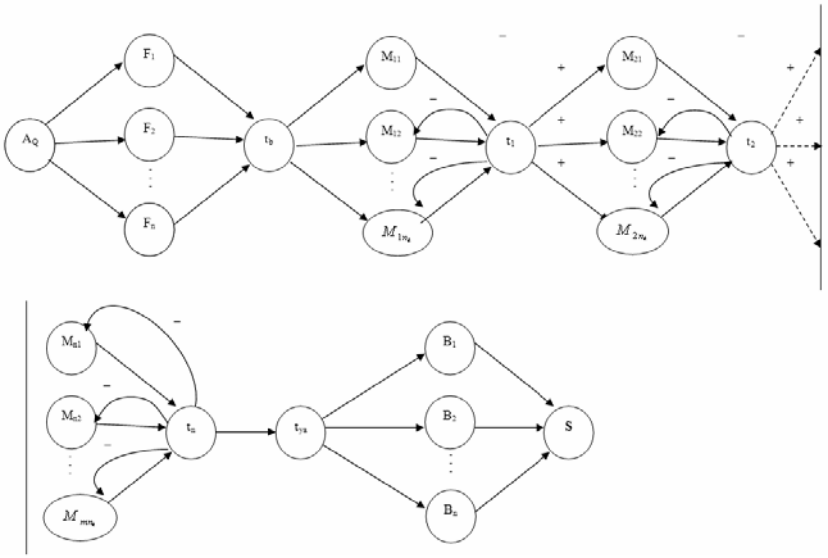

Figure 3. The Scheme of logical relations SIO (the models)

Having loaded ESA chooses the necessary subject. All subjects are collected in subject. From list that choose necessary. ESA from chosen that describe the material. After completion of the occupation on subject is conducted testing. After total of the test, is offered training following step. This process ESA database before the end is conducted. [1,2].

The second offerings model (Fig.1.) principle work ESA getting knowledge's process work is automated, in him theoretical ESA choice optimum, expert systems, cable adaptation and so give.

Having Loaded ESA training (the user) is registered, for it system, for instance "H" user forms database. This material is not closed user before the end of the process. After completion this, "H" user is not given following attempt.

* - formed on subject tests is given on order (for instance on each subject three tests). On subject not changing to 2/3 parts wrong answered, is offered begin from this subject.

** - This checking on subject on sense divided asunder, totals of the analysis and defines the following step on such principle.

The necessary subject is chosen on professions (on subject on database is entered). Here "H" consumer is checked initial knowledge's. In base of the called on checking training degree and accordingly subject of the material is generated. After report of the subject, on subject is checked. On total in base of the following step (the strategy) is developed. This process on subject last before the end all that ends total checking and is qualified. On each subject got results "results on database" is considered and is going to for total checking.

The teacher plays in process of the education main role. Create the scholastic course, pedagogical ability to betray training and gives the big effect. SIE (system of the intellectual education) is expressed totals of the expert conclusion to create the scholastic material and to be an available facility for training will be a main handhold. The logical model of the scholastic process (Fig.3) in the manner of schemes is bound with each other and is logically united in several stages. AQ trained in SIE chooses the necessary subject in complex subject ($F_1,F_2,\ldots,F_n$), the degree takes by means of initial checking t_b. Organized $M_{1i} \in (M_{11},M_{12},\ldots,M_{1n})$ gets acquainted the material, having adopted material and system defines his (its) following step. Having processed received material modulo "Controlling device" moves positive or negative side. F_i - a subject Mij sent material tn is conducted last checking. All ti is collected in database, together with total tya is analyzed and B_i is valued by estimation. On B_i S is qualified. [3].

4. Computer System of Uzbek Spellchecking

4.1 Creating algorithms

As the fundament of our work we have chosen the program, created for Spanish and English languages - *JMySpell*, which was written by using Java programming language, and the advantage of this system is its ability to work with any of existing operation systems (*Windows, Linux, MacOS, Solaris, FreeBSD* and etc.).

Hereby, when we were creating our own system, we used the vocabulary made for *Aspell* and structure of program *JMySpell*.

For creating the algorithm we also used deep materials of Uzbek lexicology from the work of Yakubova N.K. [1], where author very correctly describes the scheme of Uzbek word forms foundation and their structure (Figure 1 shows an example).

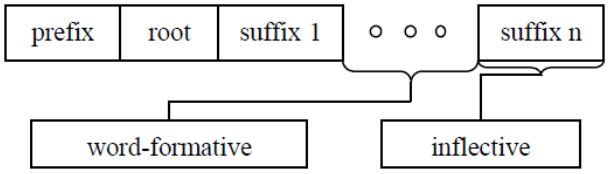

Figure 4. Uzbek word structure

Also at [1] was represented the scheme of Uzbek word forms foundation. We used it at reverse order; it means that we used it to parse uzbek words from the end (from the last suffix) but not to form them. As it can be known from the scheme, stems and affixes are divided into 2 big groups, which are different from each other. They are: V – verbs and S_0 – nominals. Nominals are divided into subclasses: S – nouns, P – adjectives, N – numerals, A – invariable stems. The group S includes all nouns (S_1) and pronouns (S_2): personal, reflexive, demonstrative, interrogative. The group A includes adverbs, undefined pronouns, and non-lingual graphic units and etc.

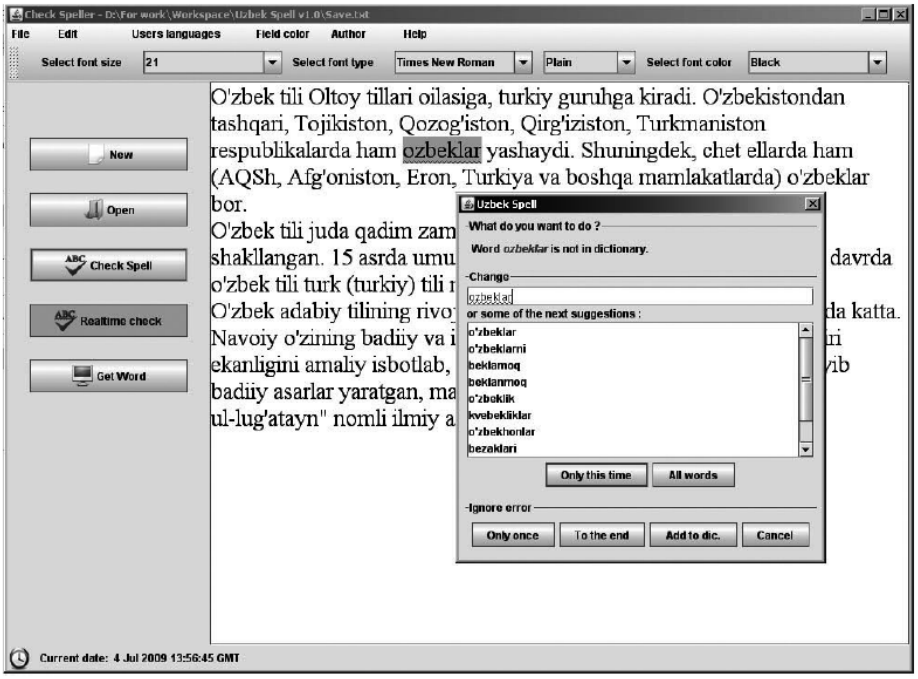

Figure 5. GUI of program

According to this scheme was created algorithm of spell checking:

– Program tries to cut off affixes from the end of word using scheme described before, and after each cutting to check, is there this word or its part in vocabulary.

– If program finds the word in vocabulary, it means that word has no mistakes.

– If after hole cutting off operation program couldn't find the word in vocabulary, it means that word written in wrong way, and program will show message with all closest words from the current vocabulary (as in *Microsoft Word*).

– If program couldn't cut off any of the affixes from the word, it means that word written in wrong way, and program will show message with all closest words from the current vocabulary.

According to the program, it requires very fast algorithm of searching in vocabulary. Needed algorithm was found in [2]. It's known as Bloom filter. The concept of algorithm is that we will not need some specialized database. Vocabulary is coded as 8-kilobytes bit-table using hash-functions and always exists in RAM. This is very comfortable to get fast answer is the word in the dictionary or not.

4.2 Developing GUI

After developing algorithms, their binding and putting together, we started to create Graphical User Interface for program (Figure 2 shows an example).

Interface of the program very simple and comfortable to use.

It's very important that program is trilingual. There are three visual parts of the program: in English, Russian and Uzbek languages. Right at the top is situated additional menu of program. It contains four specific menus:

• *User's language***.**

This item lets user to choose language of interface that is more comfortable, from existing languages-list. Three languages are available: Uzbek, Russian, English.

• *Field color.*

User may choose background color from existing list.

• *Author***.**

Authors e-mail.

• *Help***.**

There is spellchecking panel situated right under menu, at the left side of the text field. It contains five buttons:

• *New.*

Button clears text field.

• *Open*.

Using this button user can select external text file (*.txt only) and add it into text area.

• *Check Spell.*

After pressing this button program starts to analyze text and search spell mistakes. If mistake is found, then program shows additional dialog, in which it advises how to correct it.

• *Real-time checking*.

Pressing this button user turns on real-time checking system. That means that program will analyze text in its typing process.

• *Get word.*

It lets user see the word (on which caret stopped) in separate window.

5. Curriculum Development Principles of Kstu for Bachelors in the Direction "Software Engineering"

5.1 Distinction in structure SES HVT of the Russian Federation and EU//USA

In sample curricula of EU and USA are not considered disciplines of classical mathematics ("The Calculus", "Algebra and Geometry", "The Differential Equations", "Probability Theory and the Mathematical Statistics") without which in the countries of the former USSR the higher education in the field of computer science or "Computing" also is impossible.

These mathematical disciplines in various combinations are presented at all considering SES HVT RF which has been listed earlier. Therefore a high probability of their preservation in SES HVT RF new generation is saved.

Further, on performance interdisciplinary course and undergraduate thesis, and also the passing of the interdisciplinary graduation exam in a specialty makes a reservation in the SES HVT of the RF and KR previous generation. But, despite their importance in professional skills of undergraduates it isn't attributed any scores as credits. Therefore the curriculum on credit technology will not be corresponding existing SES HVT [1].

As a solution of this situations is a simultaneous working out new SES HVT that specially consider the credit technology training and the curriculum on its basis. Kyrgyz Republic,

having potential saved up for previous years of the development, can adequately solve such problem. Thus it is necessary to underline that, for ensuring of level of the competence of our undergraduates accepted in the developed countries it is necessary to reduce considerably the general quantity of hours in the block of socially-humanitarian disciplines and some time to give to general professional and special disciplines, and Training to such disciplines should be begun already with the first courses. As it is visible following, the project SES HVT RF of new generation reflects the tendency. Therefore we offer following structure SES HVT KR-2009 of in direction Informatics and Computer engineering (in brackets, for comparison the data from SES HVT KR 2003г are cited.)**:**

The general humanitarian, social and economic disciplines, volume (25 %) **19 %**

1) The general mathematical and is nature scientific disciplines, volume 16 %
2) General professional disciplines, volume 33 %
3) Special disciplines, volume (from 5 to 16 %) 24 %
4) Final state certification, volume (0 %) 8 %

For comparison we notice, that total amount of the disciplines containing in parts 2 and 3 for all above cited. 11 SES HVT RF, forms through 52 to 65%.

The general structure of project SES HVT RF in direction Informatics and Computer engineering looks as follows (in brackets for comparison are given offered SES HVT KR -2009 in credit units):

1) The general humanitarian, social and economic disciplines, volume 20 % (in KR 19 %)
2) Obligatory disciplines of mathematics and informatics (the general professional disciplines), volume 50 % (in KR 49 %)
3) The special disciplines established by high school and chosen by the student, volume 30 % (in KR 32 %).
4) Optional courses, volume over 240 cred. unit

Thus the block of humanitarian, social and economic disciplines - 46 cred.unit

The basic component *28* cred.unit

1. Russian /Kyrgyz language (9) 9 cred.unit
2. Foreign language (11) 11 cred.unit
3. Physical training –
4. History of Kyrgyzstan (5) 4 cred.unit
5. Philosophy (5) 4 cred.unit

Disciplines at a choice (high school, the student) *to 18 cred.unit*

- Social and ethical problems of Informatics and Computer engineering field (2) 4 cred.unit
- Economy (4) 5 cred.unit
- Religious studies (4) 4 cred.unit
- Technical English (5) 5 cred.unit

Block of mathematical and general nature-scientific disciplines - 38 cred.unit

The basic component *29 cred.unit*

1. Algebra and Geometry (8) 8 cred.unit
2. Calculus (15) 15 cred.unit
3. Differential and discrete equations (3) 3 cred.unit
4. Probability theory and mathematical statistics (3) 3 cred.unit

Optional disciplines *to (9)* ***9*** *cred.unit*

Block of general professional disciplines - 78 cred.unit

The basic component *70 cred.unit*

1. Discrete structures (8) 4 cred.unit
2. Programming Fundamental (8) 7 cred.unit
3. Algorithms and the complexity analysis (6) 6 cred.unit
4. Programming languages (4) 8 cred.unit
5. Architecture of computers systems (4) 4 cred.unit
6. Operating systems (3) 4 cred.unit
7. Computer networks (4) 4 cred.unit
8. Graphics (4) 4 cred.unit
9. Decision-making theory (5) 4 cred.unit
10. Databases technology (5) 5 cred.unit
11. Fundamental of Control Theory (4) 4 cred.unit
12. Optimization Methods (5) 4 cred.unit
13. Computational Mathematics (5) 4 cred.unit
14. Structure of Computers and Networking (5) 4 cred.unit
15. Informatics (5) 5 cred.unit

Optional Disciplines *till (9) 8 cred.unit*

(Distinction in credit units of previous SES HVT KR -2003 and offered has been arisen from cause of discreteness of the transform of amount of laboriousness courses from credit units to academic hours: 1 credit unit = 30 academic hours).

Block of special disciplines – 60 cred.unit

Optional disciplines 54 cred.unit

1. Algorithms design and data structures 7 кр. cred.unit
2. Functional and logic programming 4 cred.unit
3. Object-oriented programming 5 cred.unit
4. Computing Systems architecture 3 cred.unit
5. Software Design Technology 6 cred.unit
6. Programming Client-server applications tools 7 cred.unit
7. Web-programming (C #/Java) 5 cred.unit
8. Programming in Fortran 3 cred.unit
9. Web - Design 3 cred.unit
10. *Software Engineering* 5 cred.unit
11. Interaction of the person and the machine 3 cred.unit
12. Simulation of information processes 3 cred.unit

Interdisciplinary Term Papers/project 6 cred.unit

Interdisciplinary undergraduate examination 6 cred.unit
Final Undergraduate Thesis 12 cred.unit
Block of special disciplines (the list of disciplines for choice) 60 cred. unit

Table 1. Amount of students loading on term

No.	Evaluation criteria	1	2	3	4	5	6	7	8
1	Quantity of hours of the basic studies (in a week)	27	28	26	28	27	25	23	6
2	Number of examinations (in a semestre)	9	9	9	9	9	9	8	4
3	Number of course *papers*/projects		1	1	1	1	2	1	1
4	Average amount of classroom hours per week	24							

Table 2. Comparison of structure SES HVT KR -2003 and SES HVT KR -2009 by index of student's loading

№	Compared index of the bachelor curriculum	Units	Amount of Hours by SES HVT KR -2003	Amount of Hours by SES HVT KR -2009
1	Period training of the basic bachelor educational program	weeks	208	208
2	Theoretical training	weeks	136	120
3	Examinations	weeks	21	28
4	Final undergraduate thesis	weeks	3	10
5	Practice	weeks	14	14
6	Final state certification	weeks	2	4
7	Vacation	weeks	32	32
8	The maximum week loading of the student	hours	54	54
9	Maximal classes loading of the student per week at the full-time education	hours	30	30

Conclusion

Within the limits of the given scheme wide enough class of test tasks with the closed variants of answers is realized. The system is enough flexible, that does its universal. Calculation of numerical characteristics of tests, despite seeming bulkiness, it is easy algorithmed. On the basis of the given model the computer system of examination on discipline «the Computer drawing and design» is under construction.

Considered in article methods and models of management process education solves the problems an intellect systems of the education. Defining model trained we can create and realize the scenario a stage education, which each stage are divided on portion of the material. Exactly, the portion of the material realizes the main mass of the base, which distributes the module of the determination to strategies of the education. For determination of the strategies we must realize checking by condition trained, which is realized through device of the testing, in detail described in article. Within the limits of the given scheme wide enough class of test tasks with the closed variants of answers is realized. The system is enough flexible, that does its universal. Calculation of numerical characteristics of tests, despite seeming bulkiness, it is easy algorithmizated.

On the basis of the given model the computer system of examination on discipline «the Computer drawing and design» is under construction.

New SES HVT KR and the "Software" department's Curriculum in direction Informatics and Computer engineering includes in maximum degree the principles of Bologna process by students' loading in ECTS (the European system of credits).

2. The structure offered SES HVT KR covers the structure of previous generation SES HVT RF on all 11 directions (by presence of 4 blocks of disciplines).

3. Designed SES HVT KR trainees of bachelors in direction Informatics and Computer engineering by using credit technology take into consideration the structural and quantity indicators of published projects SES HVT RF new generation.

4. It is saved the essential distinction in structure SES HVT RF and Typical curricula of the USA (Computing Curricular) and European consortium Career Space:

5. There is no organizational structure like the European consortium Career Space which activity would be directed on the account of opinions of employers by working out the SES HVT. Because of it exist the main lack in the organization of ways of projects designing such SES HVT RF and KR – insufficiently flexibility and take into consideration the requirements

of the future's employees to competence of university's undergraduates and to the corresponding educational standards – the companies working in sector of information and communication technology.

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