System of knowledge revealing and rating "Cyber2"

Tea Munjishvil
Associate Professor of Tbilisi
Ivane JavakhishviliState University
tmunjishvili@gmail.com

Zurab Munjishvil
Professor of Tbilisi
Ivane Javakhishvili State University
Zurab_ztm@Rambler.ru

Vakhtang Nakashidze
Bachelor of Batumi Shota Rustaveli
State University, Facility of Mathematics
Vaxo92n@yahoo.com

Abstract
In this article we have discussed a system of revealing and rating of knowledge- "Cyber2". It is the next version /1,2,3/ of "Cyber 1", which was emplemented at Batumi Shota Rustaveli State University. In "Cyber-2" is considered all problems which were created during the two years exploitation of "Cyber-1". Systems of creating, rating and checking the tests and dictionary organization are improved. Problems about received answers and semantic analysis are solved.
The article describes the functions of the program and shows its advantages in relation to similar programs available on Georgian market. The practice of the educational institutions and our own experience shows:

1. *The conditions relevant to the compilation of e-textbooks should be created. Our school should initiate it.*
2. *To this end, an initiative group should be formed at the school to coordinate the creation of the e-textbooks.*
3. *The textbooks approved by the school should be uploaded.*

"Cyber2" is used:
The teachers enter tests and cases studies into the database for the respective subject. The teacher can create audio, video and graphic files and connect them with tests (case studies), can make edits to the database, arrange tests from simple to complex, determined the number of tests and case studies per content area, duration of the exam and passes the product to the exam center;
If the computer stops working during the exam, the last version of the test is autosaved and time spent on the test is recorded, and the student continues the exam form the point of interruption and with the remaining time.

Keywords: Computer systems, Accounting, knowledge system,knowledge raiting, "Cyber2".

Demonstration and assessment of knowledge through a computer-based system is the only option for improving a learning process. We researched the challenges of the "cyber2" system designed to allow demonstration and

evaluation of the knowledge and skills through a computer-based system at Batumi State University (BSU). Authors of the program are Z. Munjishvili and T. Munjishvili with participation of Vakhtang Nakashidze

There are sufficient number of computer-based programs for the demonstration and evaluation of knowledge available on the market. One of the examples is a computer based remote system "moodle". According to our information, higher education institutions in Georgia use moodle or other locally developed programs for the assessment and evaluation of knowledge. Unfortunately, during the research we were unable to locate and collect information on the programs for knowledge demonstration and assessment developed in Georgia.
Computer systems established at Batumi State University are functionally identical to the moodle. There are some differences /explained in table 1/
In the address there is given a advertising material of the Moodle written in Georgian language. Our analyze of "Cyber2" with Moodle stands on the information which was published in official sources and on the experiences of our colleagues. Object of our attention and comparison with a Moodle is a module with the name of "Module-test"

№	Name	Moodle „Module test"	„Cyber 2"
1	Teacher can create the database which consists of questions for multiple using them in different tests.	✓	✓
2	Tests are rated automatically (Rechecking of the test results is possible in case of the question changing).	✓	✓
3	Tests can be open during the some period, after what they will be closed and student can't pass them.	✓	✓
4	Trying the exam passing can be restricted or can be held several times and for every questions comments are allowed.	✓	
5	During the training mode trying the test passing is not restricted. For every questions appropriate conclusion is allowed. During the exam taking the tests is regulated.		✓
6	To avoid remembering the question positioning, is possible to automatically change sequence of the answers randomly.	✓	✓
7	Questions can be consisted of HTML-text, images, videos..	✓	✓
8	There are several types of questions: Answer of short answer questions is short text or phrase. Yes/no or True/False questions. Questions about searching of the compliance. Random questions. Numerical questions Questions with built-in answers Questions with variants of answers in itself.	✓	✓
9	In "Cyber2" Is realized semantic analysis of answers in Georgian language given with named and simple kind of sentences. Is allowed using the incorrect variants of words and synonyms.		✓

10	In "Cyber 2" Number of questions and the answers of question are not determined. Rating the answers is realized with different points.		✓
11	In "Cyber 2", in case of stopping the exam because of technical problems, exam will be continued from the stopping point.		✓

Demonstration and evaluation of knowledge through computer-based systems is effective in combination with the other methods. Even highly sophisticated computer systems are unable to provide opportunities to demonstrate creativity.

Demonstration and evaluation of knowledge through computer-based systems is one o f the determinants in the assessment system. BSU is a good example for the creative use of the computer-based systems, where 60% of the student assessment relies on computer-based tests, while 40% on traditional methods of assessment. Computer-based assessment – 60%-70% - is distributed in the following way: 20%-30% two midterm exams, and 40% for the final exam. Depending on the subject, the final exam is a combination of computer-based and traditional method of assessment: usually 20% - computer-based and another 20% graded through a traditional method.

Starting from fall of 2011, BSU uses a computer system –Cyber1 for mid-term and final exams, and from 2014 – "Cyber2"

Computer system –Cyber2 uses the database of open and closed test for the exams. The tests should be relevant to the subject area and content. *Closed test* is a test, where a student has to choose one or more correct answers from N number of multiple choice answers. A test is called *open test,* where a student has to answer open-ended questions. The student may need to calculate results, construct a sentence with word forms provide figures. Sentences may include numbers assigned from the accounting system, logistical transaction and etc. It should be possible to use wrong word forms, abbreviations, different forms of the words, as well as typing in necessary alphabets.

Methodological aspects of developing the tests are discussed in respective literature thoroughly [4].

Depending on the content area ratio of open tests may be as high as 100%; for example for subject areas as foreign languages, linguistic speech, etc.

Computer program used at BSU allows:

- To administer mid-term and final exams with large number of students in various subjects simultaneously;
- To conduct exams in a subject by student specialization.
- To select maximum three correct answers from multiple-choice question with seven options of answers;
- and in opened tests number of answers is not determined and answers could be rated with different points.

- To illustrate any test or ask a question using graphic or video representation. At the departments were international students are enrolled, audio player is used for subjects lie Georgian language vocabulary and grammar, Georgian speech and conversation culture. The student listens to the Georgian word, sentence has to select or provide a correct answer;
- To activate or deactivate the bar showing correct answer when a student responds incorrectly;
- To show warning notes when a word is spelled incorrectly or a sentence is constructed with a mistake. For example, the first type would say – you used a word that is not recognized by the system; A student used the word "analysis" instead of a word "debit", the second type - you have not answered all questions. In the first example, the system asks the student to clarify, in the second note it reminds the students about the questions that still need to be answered. If a student provides correct answers points are accrued, if not the system suggests a correct answer.
- To type answers in Georgian or Latin alphabet;
- To administer a test in various languages simultaneously for the same subject (in Georgian, English, Turkish, etc.);
- To type word forms, incorrect forms and abbreviations in the answers;
- To evaluate the question with two correct answers with proportional or full scores;
- To assign values to correct answers in simple and complex tests;
- To formulate the test questions according the content area, discipline and specialization of study;
- To print student lists who take an exam;
- To select relevant tests for each student before beginning the administration of a test;
- To rearrange the correct answers in the multiple choice tests to eliminate the correct responses based on probability.
- To review a report at the completion of the exam;
- To renew the test database in the system;
- To minimize the test review time using the automated scoring system;
- To review student appeals simultaneously with the administration of the test through the second review;
- To record data in an electronic journal;
- To organize electronic reports according to the scores in each evaluation component, as well as final scores for a term;
- 2012/2013 exams were administered using a computer-based system "Cyber1" at all departments in 170 subjects. Approximately 70% of tests were open and 30% were closed. Audio questions were used for international students to assess knowledge of Georgian language in the following subjects: "Strategies of oral communication" and "Aspects of Communication in Georgian Language".

For conducting the exams it's important to create optimal exam schedule. With examination groups, number of students by group and by number of exams we need to create such exam schedule, that the time T_n of conducting all exams was minimal. And number of workplaces- p (working

computers), in which are not included number of reserve computers, are not limited.

Suppose that number of examination groups is - N_i(i=1,2,…,n), number of students in separate groups - M_i(i=1,2,…,n), examination subjects - – S_k(k=1,2,…,s), number of examination subjects $S_{Nj} \epsilon S_j$which should be passed by groups is R_i(i=1,2,…,n). Then $N = \sum_{i=1}^{n} R_i \cdot M_i$ gives us number of workplaces which are needed for all exams. By according to the durations of exams, during the day exams can be held in some z amount of shifts and during the day we will receive $N_{tmax} = z \cdot p$ students at exams. It lets us to determine the number of working days needed for all exams $T_n = roundup(\frac{N}{N_{tmax}})$ and calculate optimal number of students which will attend exams during the working day $N_o = roundup(\frac{N}{T_n})$. We mean that all magnitudes are natural.

We should consider following restrictions:

- Number of working days should not be more than maximal number of exams in group.
- In one working day given group should not perform more than one task.
- The number of students N_z in shift should not be more than workplaces p. and $p - N_z \geq 0$ magnitude should be minimal.
- If it is possible, exam of current subject should take place in one working day.

In our case number of examination group is 128. Every group had 2-4 exams, in 168 different discipline and there were 9256 student-exams held.

In this report we are focusing on learning, namely by means of computer systems. In any syllabus, independent work makes up 60% of overall studies. A student should familiarize oneself with the learned and forthcoming materials, solve tasks, do sums and analyze the issues raised by the teacher. To this end, a student should obtain the relevant literature in the native language. The Internet is a world library, which makes it possible to publish texts, as well as the graphic, audio and video information relevant to the individual instruction. The example makes it clear that merely everything can be structured and that a one can always set a task relevant to the learned material. We believe that any issue could be depicted in the e-textbook by way of supply of textual, graphic, audio and video information.
There are various kinds of e-textbooks, all across from the most simple PDF to the more complex HTML files with the sophisticated search engines. It's the same with the video lectures: the ordinary 30-60 min. or topical 15 min. ones, with the video embedded self-verification open and closed type tests.

The e-learning Moodle system is an instance of comprehensive approach to the problem. It involves compilation of e-textbooks and test training. As

the practice has demonstrated, compilation of textbooks and creation of a test-base is a laborious task, which calls for specially trained lecturers, especially where the test and task base is concerned.

The IT Internet University has found an efficient and simple way of compiling the e-textbooks. Those are created in the HTML format, with the duration of a video lecture not over 30 min. Each lecture ends with questions for self-testing. There are but few textbooks containing a combination of the textual, graphic and video information /3/.

Studying involves several elements: familiarization, learning, self-verification and getting clarification of incomprehensible issues. Reading and listening is not enough. Verification of what one has learned is no less important. The instruction involves feedback. A teacher puts questions, sets tasks on a taught issue, verifies the answers, if necessary, re-explains, points out the reasons behind a student's mistake and, finally, shows how a task should be solved or solves it himself.

Studying by means of an intellectual system will imply: a user starts studying a subject by selecting the relevant level. A subject is taught by means of e-textbook containing illustrating texts, graphics and videos. Self-verification is an integral part of learning. The system offers to describe a typical situation, which has been discussed and controls the description all along. The result of a user's action is automatically compared to the one in the base. In case of an inaccuracy, the system offers to select another way. The user can follow the system's decision-making.

Learning of a theoretical or a practical issue is a multiple process. The final stage is the appraisal during an examination.

The obtained knowledge is assessed by the relevant software, which is an integral part of the intellectual instruction system /4,5/. The software contains randomly selected exercises and the answers are verified according to the teacher's tasks. There are two kinds of exercises: first - among the likely answers, a student can select more than one right answers; second – a student should enter the answers by way of book entries, calculations or simple sentences in the Georgian language. There may be several answers to a task. A wrong answer is displayed in the knowledge base.

The is a multilevel knowledge base. In training or an examination, the teacher determines the number of levels. After a training (an examination) the user familiarizes with its process and the substantiation of the answers. According to the result, the system suggests the most acceptable learning strategy.

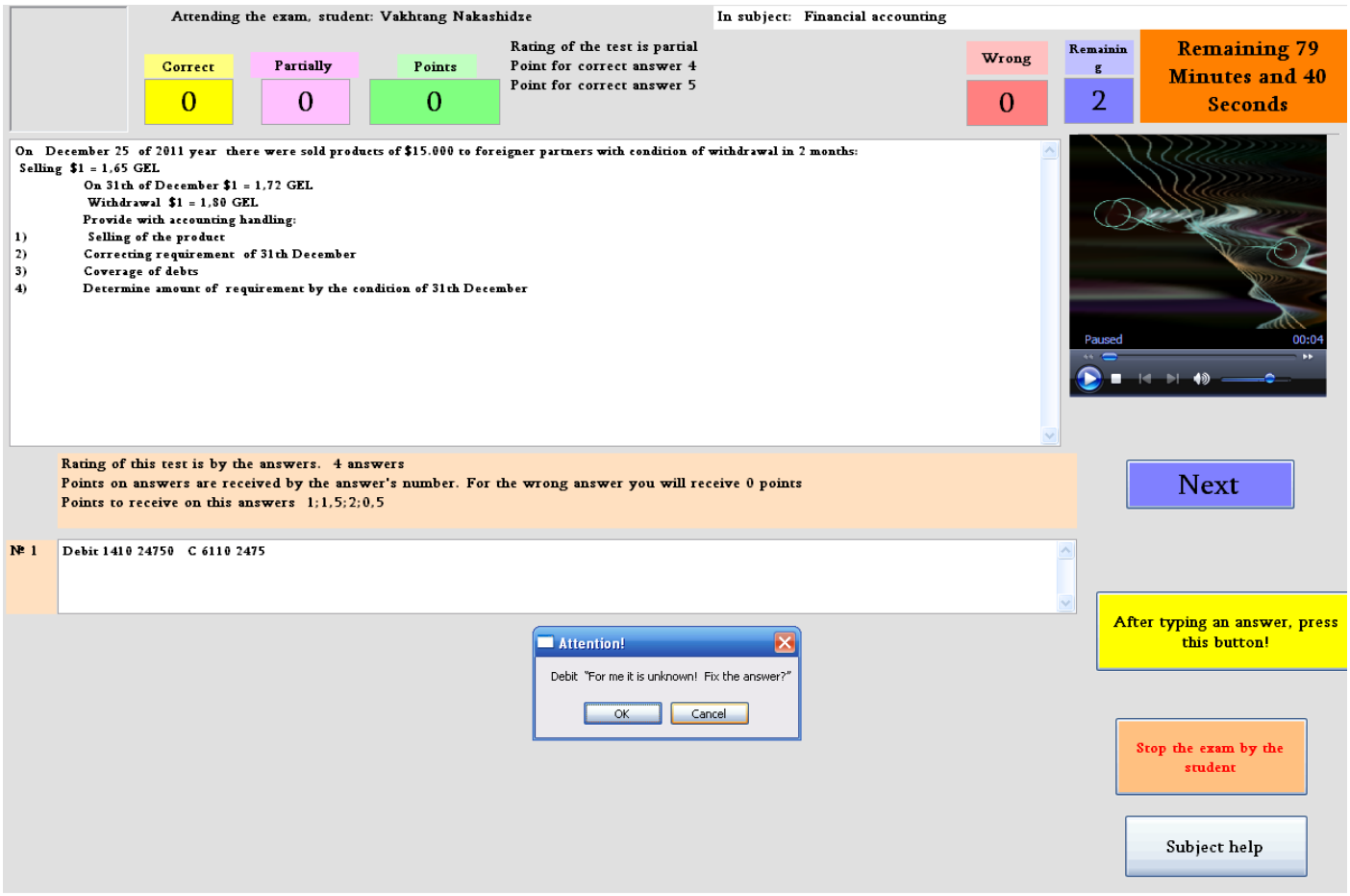
After acquiring knowledge and students' self – testing directly with the next teacher, extended studies of material generalization, doing exercises and sums should be accomplished through dialogue. We mainly focus on the software computer system for holding trainings. The article further refers to the computer program of "cybertesting" for exposing knowledge and its estimation system with the help of which the vision of

updated education system is achieved (the author of the software package: T. Munjishvili. Z.Munjishvili).

The basis for any software computer system is the multiplicity of material, formed through software education method and tasks and exercises, reflected through it. The number of issues is determinative. Probability selection of few issues among others is implemented during the trainings and estimation. Relativity between the methods of exposing knowledge and estimation with traditional and computer programs may compose the following 1:1, 2:1, 1:2, 1:0, taking into consideration the specifics of certain subject. For example, if the general degree for the intermediate estimation is 60 points, then according to the specifics of the subject 20 points with teachers' traditional methods of estimation (essays, coursework, activities, others) and 40 points by software systems shall be determined and vice - versa.

Any problematic issue should be represented as the entire work of theoretical and practical exercises. The basis for studying theory and its estimation is testing system. As commonly known, the tests presently mean one correct answer per N conjectural answers per question. Practically the following relativity between correct and wrong answers is adopted: 1:2, or 1:3, i.e. one correct answer should be selected for 3 or 4 questions. In terms of such testing, the probability of correct answer by the student increases without deep comprehension. The testing process is complicated, if 2 or 3 correct answers should be selected among N conjectural answers and the relativity between the correct and wrong answers is the following: 1:3. The tests, where the multiplicity of conjectural answers is given and the correct answers should be selected among them, is called closed types of tests. The open type of tests is where students are required to write answers and not select them. Here, the number of answers to the task is not actually limited. The answers may be numbers, words, sentences, or their combinations:

In foreign language the common form of assignment is represented as a text. In the sentence, there are few words, missing, which should be found by the student. In such a task, there are dozens of answers. The structure of the task (open test) is the following:



Picture 1: Task structure (open test

On the picture, there is reviewed an example, where rating of the tests is partial. After typing the first answer and pressing the button "After typing an answer press this button!" there is checking number of words in sentences and existing in dictionary. Here we see the message, showed by the system, about the existence of the word in dictionary.

The software system should acknowledge wrong versions in any case and conjugation of the used words, existing in answers, as well as syntax and semantic analysis of the sentence.

Naturally, both tests should be grouped according to the subjects and the number indicated in advance per subject should be accomplished through probability. In this case, the relativity between the number of open and closed tests are essential. The number of open tests should be preferably equal, or maximum twice as much to the closed ones. At the same time, the difference between the estimation points of the open and closed tests is also important. Practically, the point for the correct answer in terms of the closed test, should be 4 times less than that for the open ones. The contents of the tests are of great importance. Surface contents of the test is discrediting for exams and education process. Both types of test should be formed of several complications. In training mode advancing

from one level of complication to the upper stage should be accomplished with certain criteria.

The software program developed by us and put into operation for further exposure and estimation of knowledge – Cybertesting satisfies all the requirements above. Preparing and holding trainings and exams with "cybertesting" consists of the following stages:

1 Formation of database for tests and organizing dictionary;
2 Formation of assignment for training, intermediate and final test;
3 System functioning: trainings, intermediate tests, final exams;
4 Printing protocol and other information describing the proceeding of examination.

The system is multi lingual. The given version includes the realized multi-lingual versions – in Georgian, English, German and Russian languages. Adding the unintended language in system is possible with translating of sentences from existing language in appropriate table and writing them in the table. This operation occurs only once.

Any task may be illustrated, or published with visual pictures, graphic images or videos. The formation of colloquium and exam assignments together with the duration of exam shall be implemented by the lecturer with the given assignment. The tasks composed on the subject refer to the topics, anticipated by the syllabus.

For example, first topic is determined tests with numbers 01001-01050 where 01001-01030 are closed tests and 01031-01050 are open. On the other hand from closed tests 01001-01010 are such tests where from N possible answers should be answered just one correct answer and 01011-01020 are such tests, where from N possible answers should be answered just two correct answers and 01021-01030 are tests with 3 correct answers. Rating of tests with 3 correct answers is partial but other tests are not. So, one topic is divided by difficulty levels. Tests with different levels are rated by different points. In open tests answers should be written. Number of possible answers in any tests is not determined. All answers are rated by different points.

During the exam, this information is shown on the screen. After writing the first answer student is fixing it. Information about the correctness of the answer will be outputted. It is continuing for all answers with the same way. Student is receiving the appropriate point. This process occurs when rating is partial. If rating of the tests is not partial, for the wrong answer system is giving the zero point.

If the task is illustrated with a graphic image or video, then on the right side of the window, the picture, or video will appear. By clicking on it, the image is enlarged or returns to initial sizes.

The training/exam is ended: as initiated by the student or upon giving answers to all questions or expiration of time limits. In any case, the detailed information about the exam is generated including the following: the points, received by the student, the number of correct, partially correct, or wrong answers and missing tasks, the reason for ending exam.

The results of the exams shall be published on the website realized by the ASP.NET Technologies.

Programming pack of System of knowledge revealing and rating "Cyber-2" is written on the programming language –VB.Net 2010. Database is organized on the platform of Micosoft sQL server2008 and Windows serer 2008. The task of optimal exams schedule is realized in Microsoft Excel by using the programming pack SOLVER.

This report depicts the first version of Intellectual system for the obtainment of knowledge, with the textbook given in HTML format. A topic is presented by way of a text, graphics and video materials. The textbook is placed on the FTP server. The training adapted knowledge demonstration and appraisal system we developed is an integral part of the textbook. The system is placed on SQL server and operates by means of the client-server hi-tech.

By the student's side, advantages of the Cyber2 are:

- In closed tests, after selecting the answers, fixing them by clicking the button, which excludes the so called "accidental clicking" during the answering.
- Displaying the warning message during the answering the questions in open tests. Messages like: Using the existing words in dictionary, adding/subtracting words in sentence.
- Displaying the information in open tests about correcting/correcting and adding the points for every fixed answers.
- Knowing about the remaining time of exam, remaining number of tests and answers and about the received points.
- Demand the appellation immediately after the exam.

By the student's opinion it is necessary, that in every subjects where exams are held with the computer, during the semester: 1) quizzes, to be held by this system. 2) To be possible solving the task, answering the tests, receiving the information about tasks, subjects and so on.

By the teacher's opinion formation of the tests and tasks in the beginning is consuming creative work. Adding the closed and open tests in Cyber2 is easy and does not need the preliminary training. By the opinion of the teacher's majority, It is especially comfortable: first - existing creating the base of tests and tasks with automatic mode and afterwards moving them in the central basis by the system administrator; Second – In case when several teachers have the same subject, creating the common (typical) or different basis of the tests and tasks and conducting the appropriate exam. Which is impossible with in Moodle. System of managing the databases, for creating the tests basis in automatic mode, is Access.

Revealing and rating of the knowledge with the computer system makes teacher free from the consuming processes of exam helding and pressure form several sides. In case of creating the good tests and tasks, the revealed knowledge is relevant to the received knowledge.

In subjects, where thought and creative skills should be revealed, is not reasonable to reveal and rate knowledge with the computer system. Like it is happening at Batumi Shota Rustaveli State University.

References

Z. Munjishvili, T. Munjishvili, A. Meladze. Knowledge Demonstration E-System. Sakpatenti, certificate of recognition #5222. 2012

Z. Munjishvili, T. Munjishvili, A. Meladze. E-System for Planning and Management of Instruction. Studies of the North-West Polytechnic Institute. 5pp. NWTU Press. Saint Petersburg. 2011

Z. Munjishvili, O.Nakashidze, Sistem if Reveling and Evaluating Knowlage. Material Intrnational scientific-practical Conference, "Modern Problems of Social-Eeconomic Devlopment and Informatization: New Challenges and Perspectives", October 26-27-2013, Kutaisi (Georgia), p.175-179.

M.B. Chelishkova. Theory and Practice of Compiling of Instructional Tests: Manual. M. Logos, 2002. -202p.